Construction Methods

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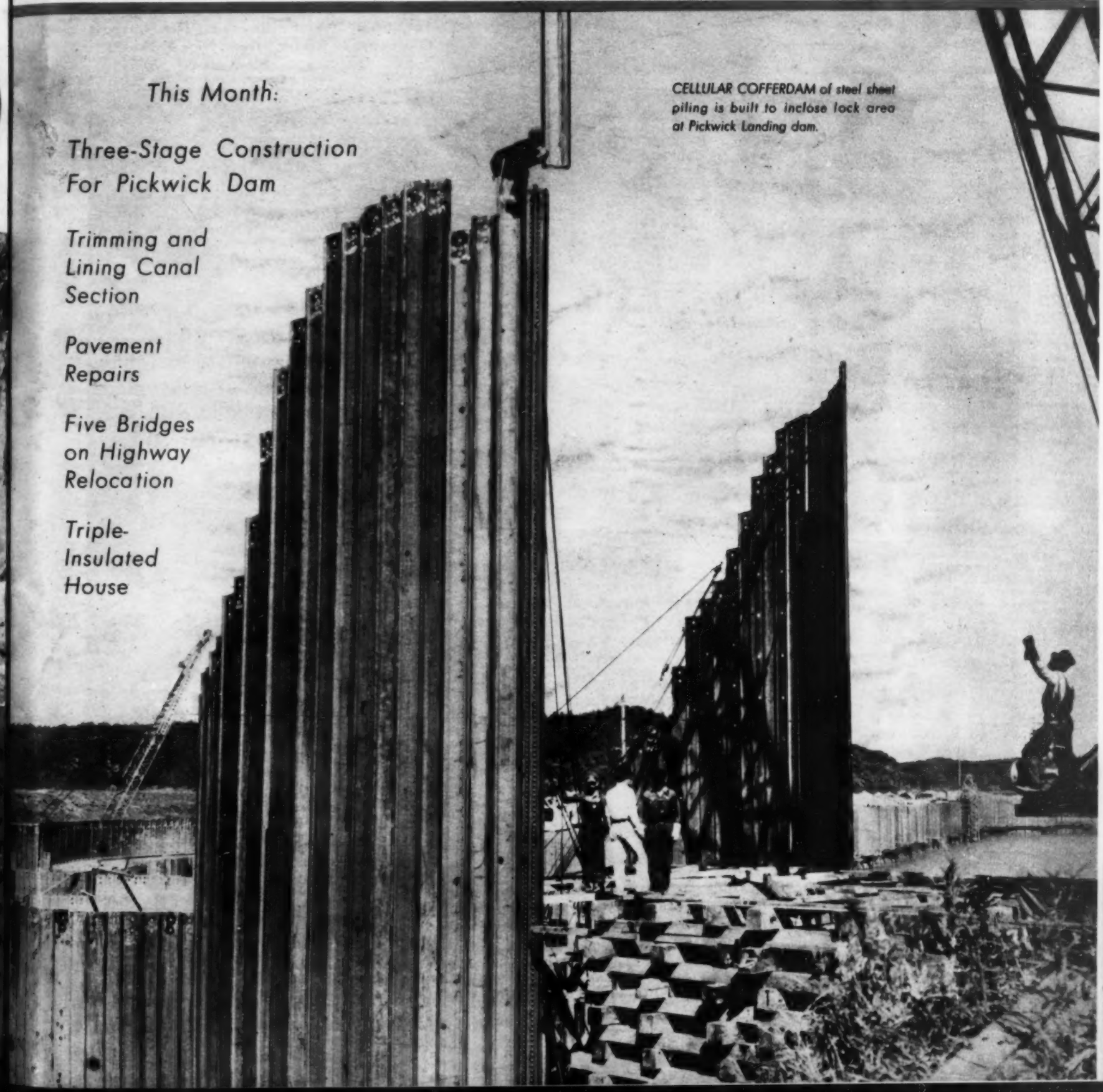

CELLULAR COFFERDAM of steel sheet piling is built to inclose lock area at Pickwick Landing dam.

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Construction Methods

McGraw-Hill Publishing Company, Inc.
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ROBERT K. TOMLIN, Editor

MAY 1936

WILLARD CHEVALIER, Vice-President

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Current Jobs

Highways

With the advent of spring the state highway departments have been active in starting their 1936 road-building programs. Among recent contract awards have been the following: In Iowa, $215,751 for 8.26 mi. of paving, to **J. S. McLaughlin & Sons,** of Des Moines. In Texas, $300,913 for 12.1 mi. of concrete paving to **Harrison Engineering & Construction Co.,** of Kansas City, Mo.; $189,000 for 10.75 mi. to **Womack-Henning Construction Co.,** of Abilene, Tex. In Michigan, $216,373, for 5.2 mi., to **James A. McKay & Sons,** of Detroit. In Montana three contracts, totaling $369,076, to **Tomlinson-Arkwright Construction Co.,** of Great Falls, Mont. In California, $194,385, for grading and oiling 8 mi. to **R. B. Carlson,** of Stockton, Calif. In Indiana, $158,430, for 7.4 mi. of concrete paving, to **Highland Co., Inc.,** of Louisville, Ky. In Pennsylvania, $197,399, for 4.72 mi. of concrete paving, to **Baldwin Bros. Paving Co.,** of Cleveland, O. In North Carolina, $199,728, for 14.8 mi. of grading and bituminous surfacing, to **E. W. Grannis,** of Fayetteville, N. C. In Nevada, three contracts for 75.6 mi. of grading and gravel surfacing, totaling $346,787, to **Utah Construction Co.,** of Ogden, Utah. In Rhode Island, $240,511 for 3.4 mi. of concrete paving to **Lane Construction Corp.,** of Meriden, Conn. In Connecticut, $404,764 for 13,575 ft. of grading and drainage at Stamford, to **Osborn-Barnes Co.,** of Danbury, Conn.

Buildings

Public—**E. S. Williams,** of Scranton, Pa., received a $1,071,245 general contract for a junior high school at Scranton. At Springfield, Ill., **United States Fireproofing Co.,** of Chicago, bid $897,540 for an arsenal and office building. A contractor for an industrial high school in New York City went to the **Comstock Construction Co.,** of New York, for $886,600.

A number of public building contracts in the half-million dollar range were awarded as follows: Coliseum at Centennial grounds, Fort Worth, Tex., to **James T. Taylor Co.,** of Fort Worth ($459,089); college building at Ann Arbor, Mich., to **W. E. Wood Co.,** of Detroit ($500,000); municipal power plant in Grand Forks, N. D., to **Donovan Construction Co.,** of St. Paul, Minn. ($650,000); high school at Tallahassee, Fla., to **T. A. Monk,** of Bradenton, Fla. ($400,000); school at East Rochester, N. Y., to **Stewart & Bennett, Inc.,** of Rochester ($500,000); mineral water spa building at Excelsior Springs, Mo., to **McDonald Construction Co.,** of St. Louis, ($437,136).

Industrial—At the Ford River Rouge plant, Dearborn, Mich., a 10,000,000-cu. ft. gas holder is being built for $1,000,000 by **Stacy Bros. Gas Construction Co.,** of Cincinnati. For a plywood plant at Hoquiam, Wash., the **Grays Harbor Construction Co.,** has a $500,000 contract.

Commercial—**Toschrist Bros.,** of Rochester, N. Y., are building 70 residences in Brighton, N. Y., to cost about $500,000. **Patrick Construction Co.,** of Brooklyn, N. Y., is building in that borough a 10-story apartment to cost over $400,000.

Bridges

Recent contract awards for bridges and grade elimination structures have been made to: **Joliet Bridge & Construction Co.,** Joliet, Ill., $121,301 for viaduct in Cook County, Ill.; **T. A. Loving & Co.,** of Coldsboro, N. C., $193,981, for overhead crossing in Roanoke, Va.; **Haley, Chisholm & Morris, Inc.,** of Charlottesville, Va., $144,188 for overhead crossing in Newport News, Va.; **Wilson & English Construction Co.,** New York City, $254,221 for a grade crossing in Queens County; **C. F. Vachris, Inc.,** Brooklyn, N. Y., $215,727 for bridges in Nassau County, N. Y.; **H. L. Harrison & Son,** of Newark, $145,832, for grade crossing elimination in Berkeley Heights, N. J.; **Merritt, Chapman & Scott Corp.,** N. Y. City, $1,028,303, for substructure of Connecticut River bridge between Middletown and Portland; **Bethlehem Steel Corp.,** Bethlehem, Pa., $1,085,594 for superstructure of foregoing Connecticut River bridge.

AND WHO'S DOING THEM

How—

... For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:

Current Jobs

Sewers and Waterworks

Among sewer contracts awarded have been: Trunk line in Little Rock, Ark., to **Nolan Construction Co.,** of Detroit, for $431,505; also in Little Rock, Ark, sewer contracts of $397,550 to **Drainage Construction Co.,** of El Paso, Tex. In Detroit, **S. A. Healy Co.,** of Detroit, has a $684,103 intercepting sewer job. **De Lashmutt Bros.,** of Arlington, Va., are building an outfall in Frederick, Md., for $239,072. **A. J. Forschner Construction Co.,** of Cicero, Ill., bid in for $441,998 a contract for Chicago's Calumet intercepting sewer. In St. Paul, Minn., a sewer contract for $786,782 was awarded to **A. Johnson Construction Co.,** of Minneapolis.

The Eagle Mountain pumping station on the Colorado River aqueduct will be built by **L. E. Dixon,** of Los Angeles, for $819,316.

Unclassified

The U. S. Bureau of Reclamation awarded two contracts for earthwork and tunnels on the Gila Valley project in Arizona and California, one of $273,600 to **Boyce & Igoe,** of Yuma, Ariz., and the other, of $681,575 to **Mittry Bros.,** of Los Angeles.

Council Bluffs, Ia., has given to **E. A. Wickham Co.,** of Council Bluffs, the Indian Creek flood control job, for $365,000. Another section of the same project has been awarded to **Union Construction Co.,** of Des Moines, Ia., for $214,700.

For a boardwalk at Long Beach, N. Y., **Faircroft Engineering Co.,** of Brooklyn, were successful bidders at $701,941.

Wm. P. Neil Co., of Los Angeles, is building in that city a new wharf costing $388,000.

Project Progress

Cajalco Dam—Placement of concrete lining in the diversion tunnel at Cajalco dam, being built to form terminal reservoir for Colorado River aqueduct in California, was begun in March by crews of **Broderick & Gordon,** contractors, of Mecca, Calif.

Another TVA Dam—Another big dam, 425 ft. high, to be located on the Little Tennessee River at Fontana, N. C., is planned by the Tennessee Valley Authority, which already has five other large dams—Norris, Wheeler, Pickwick Landing, Guntersville and Chicamauga—under construction.

Railroad in Oregon—The Interstate Commerce Commission has granted authority to the **Gold Coast Railroad** to build a new line between Leland and Port Orford, Ore., at a cost of $4,500,000.

Peak Employment on Aqueduct—General Manager, F. E. Weymouth of the **Metropolitan Water District,** announced a new employment peak on the Colorado River aqueduct in California, where 8,200 were at work April 1 on a 300-mi. construction front.

Housing Forecast—A revised survey by Stewart McDonald, Federal Housing Administrator, raises from 175,000 to 250,000 his estimate of the number of homes to be built in the United States during 1936. In 1935, according to Housing Administration figures, 85,000 dwelling units were built in this country.

Pipe Line Contracts—Covering a length of 219,560 lin. ft., contracts for the distribution pipe lines of the Colorado River aqueduct in California are held by: **American Concrete and Steel Pipe Co.,** four sections (precast concrete)totaling 83,113 lin. ft.; **J. F. Shea Co., Inc.,** two sections (precast concrete) totaling 57,392 lin. ft.; **United Concrete Pipe Corp.,** one section (precast concrete) totaling 24,525 lin. ft.; **Western Pipe & Steel Co.,** one section (welded steel pipe) of 54,530 lin. ft.

AND WHO'S DOING THEM

Time for No Little Plans

No doubt can remain that construction now is on the march. Of course we still are far short of the 1929 peak or even of the normal level. Figured against those objectives, we still have much room for improvement, but figured against the low point of three years ago we have made heartening progress.

For all construction, including heavy maintenance, the year 1935 showed an increase of about 19 per cent over 1934. The first quarter of 1936 showed an increase over the first quarter of 1935 of about 100 per cent. In March, engineering construction awards alone exceeded those of March 1935 by 65 per cent.

Even more significant than these totals is the substantial increase in construction financed by private capital. Of the gain from 1934 to 1935, private work accounted for almost all: residential building increased 92 per cent; industrial building 64 per cent; the volume of public works did not increase. During the first quarter of this year the increase in private heavy construction over the first quarter of last year was 119 per cent while that of public construction was 90 per cent. Every indicator points to a continuance of this progress.

This does not include residential building which, estimated for 1935 at 65,000 to 80,000 family units, should nearly double in 1936 and may show another hundred per cent increase in 1937. It is expected that we shall resume a normal rate of house building in about three years; after the normal rate is reached, we still must make good a deficit of some 2,000,000 family units, which began to accumulate in 1930.

Much the same considerations that apply to residential building hold also for industrial and utility construction. Already industry is rebuilding to make good the shortage accumulated by depreciation and obsolescence; the utilities are ready for a similar revival just as soon as they can see more clearly through their own special problems. Commercial buildings, not subject to quite the same degree of obsolescence and with no such deficiency to make up, will follow, although somewhat more slowly, in the march back to normal.

Although the prospects for public construction may be obscured for the moment, there is no reason to doubt that volume will be well maintained during the current construction season. Moreover, it seems certain that this progress will continue, although it is both probable and desirable that the increase in private construction will reduce the relative importance of public works in the construction picture. For some years to come, however, the need for improved facilities and the demands imposed by new residential construction will insure a continued construction of highways and other public facilities. The processes of financing and administration may be modified, probably for the better, but the work must be done.

Those manufacturers of materials and equipment who have kept their products and services up to date, who have strengthened their sales and distributor organizations and who have maintained aggressive sales promotion already are feeling the benefits of this upward trend. As private construction becomes more of a factor, quality becomes relatively more important and sales promotion becomes correspondingly more necessary and effective. Some manufacturers have enjoyed an increase in sales volume rather because of the sudden release of a deferred demand than because of their own efforts; if they would hold their gains they will find it necessary to strengthen their selling efforts as this first surge of buying flattens out into a more stable demand.

All in all, the outlook for the industry as a whole is more heartening than it has been for several years. Some hazards still loom; some obstacles still must be surmounted; federal relief policies still complicate public construction; the misappropriation of highway revenues still must be fought.

But when we see construction volume already climbing so rapidly back toward normal, with a prospect of even more noteworthy progress during the coming year, when we know that an increasing share of this gain comes from private enterprise and investment and when we consider the vast reservoir of deferred improvements — homes, factories, warehouses, power-plants, shops and all the rest of the public and private facilities that have been held off during recent years — every element of the industry is justified today in making "no little plans" for the period immediately ahead.

Willard Chevalier

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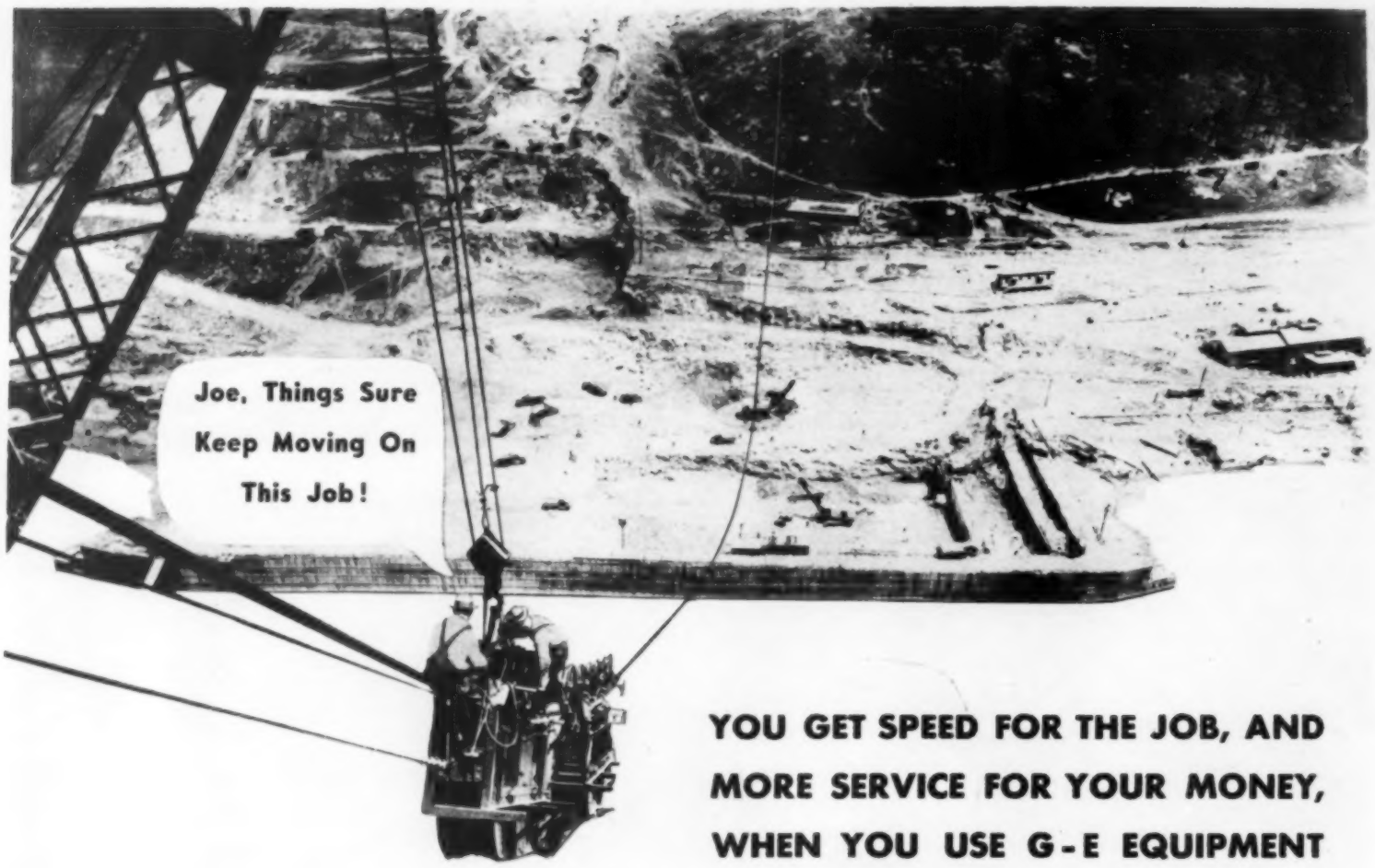

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THE EUCLID ROAD MACHINERY CO.
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Deepening and widening the Quilcene River, to prevent floods, this "Caterpillar" Diesel Tractor works with a bulldozer at a fuel cost of less than 12 cents an hour.

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THESE ARE SHOW-DOWN FACTS:

A contractor on the Florida Canal reports: "Our four 'Caterpillar' Diesel Tractors are moving 48,000 cu. yds. of sand per 6-day week. All are working 24 hours a day, averaging 83 yds. per hour per tractor on a 500-ft. loaded haul up a steep grade, climbing from 30-ft. cuts to dumps 15 or 20 ft. high."

"At an average fuel cost of only 14½ cents per hour," writes a Connecticut owner, "our 'Caterpillar' Diesel Tractor, equipped with bulldozer, has been handling 2500 cu. yds. of fill material per day."

CATERPILLAR DIESEL

REG. U. S. PAT. OFF.

MOVING A 4000-TON HOSPITAL 165 FT.–IN 1 HR., 58 MIN.

1 *To make room for Louisiana State University's new Medical Center Building, New Orleans, this 5-story, 4000-ton Charity Hospital structure was moved 165 ft. to a new site. Job was successfully completed in record time without loosening a single brick or section of cornice in the building.*

2 *Eight steel tracks of 24-inch I-beams were set in 'Incor' concrete. Similar I-beams were bolted to the structure's floor sills. Between tracks, 2 ft. apart, flanged steel rollers were placed. Then, supporting pillars and walls were cut away, and building was on rollers, ready for moving operation.*

3 *Yielding soil conditions made doubly important proper support for steel track on which the building was to be moved. To reduce expense and avoid waste time waiting for concrete to harden, contractor used 'Incor' 24-Hour Cement for runways from old to new site and for new foundation.*

4 *At 1:40 p.m., a 60-h.p. steam engine, shown above at old foundation, was ready to pull the structure to its new location. Steel cables, rigged to exert a force 17 times the power of the steam engine, moved the building about 1½' a minute. The task was finished at 3:38 p.m., in 1 hr., 58 min.*

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CONTRACTOR'S time-analysis shows 'Incor' saved 2 weeks in moving this New Orleans Charity Hospital 165' to new location. Corresponding reduction in overhead expense alone, repaid 'Incor's slight extra cost several times over. Other savings were "velvet."

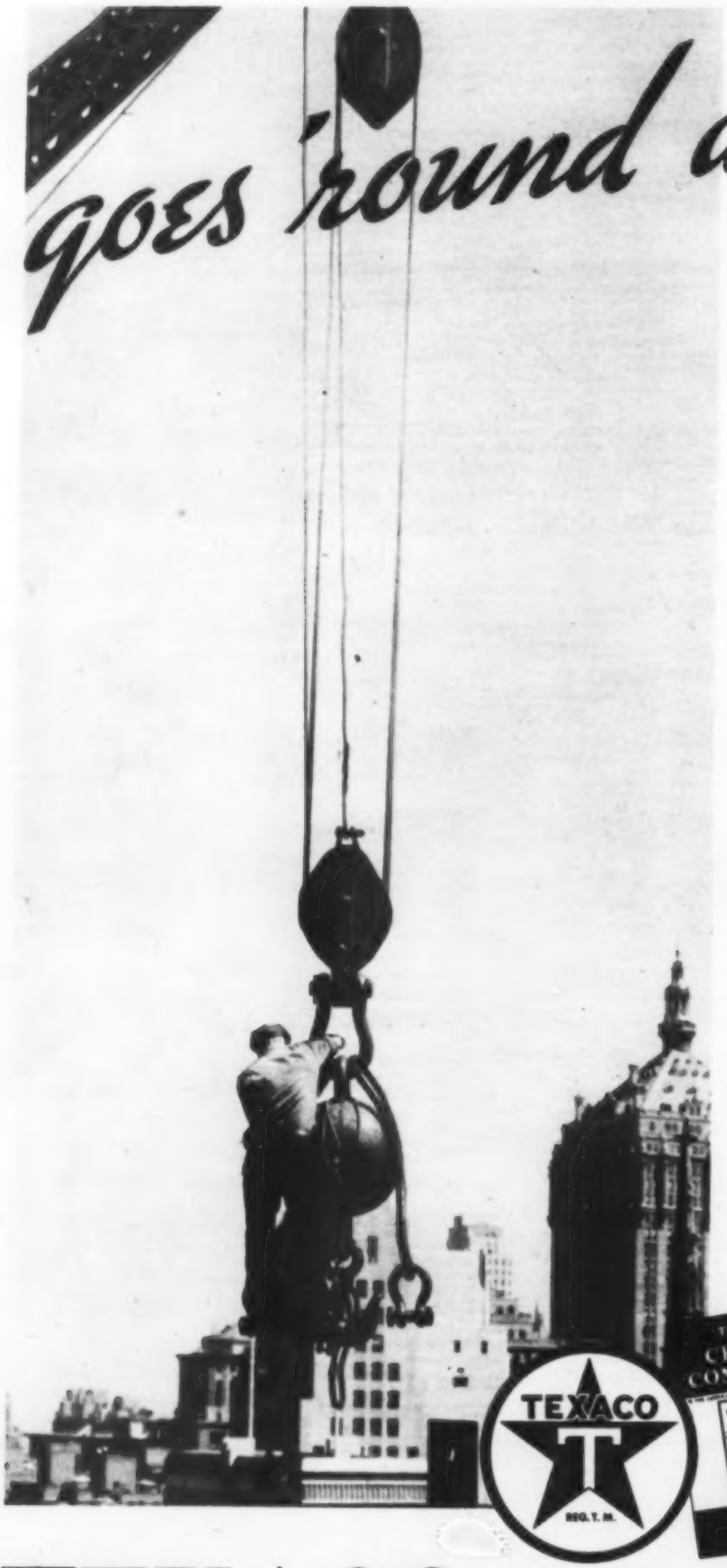
'Incor' runways from old to new site were ready for use day after last concrete was placed. Overnight form stripping speeded completion of new foundation, reduced form costs. Emphasizing once more that it doesn't have to be a "rush job" for 'Incor' to save money. Consider it from the standpoint of reduced labor cost: the job goes ahead without interruption; labor is continuously employed; men do not have to stop concreting and pick up something else while concrete hardens. These and related advantages mean reduced labor cost—through increased man-hour production.

'Incor'* is made and sold by producers of Lone Star Cement, subsidiaries of International Cement Corporation, New York; also sold by other cement manufacturers. *Reg. U. S. Pat. Off.

'INCOR' 24-Hour Cement

WIRE ROPE

goes 'round and 'round for years



. . . when it gets this simple care

The condition of the *inside* of your wire rope may decide whether the job will run on schedule—or be held up.

Wire rope is lubricated at the mill, of course—including its hemp core.

You can keep the hemp core and inner wires of your rope "like new" by periodic hot applications of Crater.

THIS GREATLY EXTENDS ITS LIFE

Each individual wire in each strand will be coated in a tough, viscous film that—

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. . . preserves the hemp core against deterioration.

Ordinary greases do not penetrate . . . they merely smear over the surface . . . Remember, Crater is not a grease at all. It is a specialized mineral lubricant. Hence, applied to wire rope, it does not have the disadvantages inherent in greases. Greases should not be used on wire rope.

Have your rope laid at the mill on a center impregnated with Texaco Wire Rope Compound . . . and keep it lubricated with Texaco Crater.

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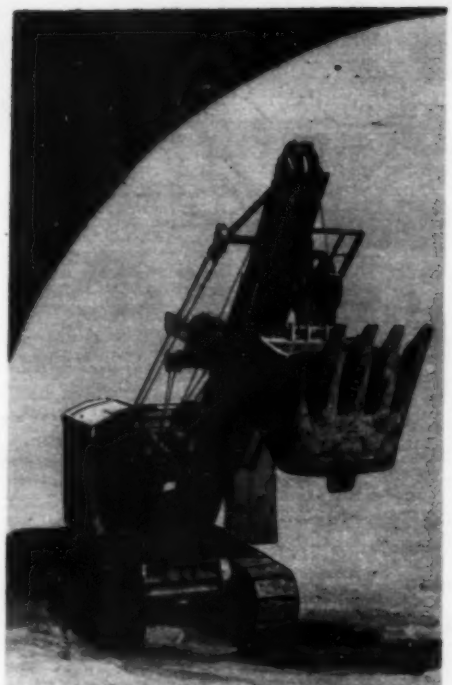

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Look at a line in which you can have not only the economies of low Diesel operating costs, but the advantage of low upkeep costs. P&H builds for Diesel power—every part is designed to stand up under the heavy "lugging" ability of a Diesel.

Look at a line in which less dead weight, lower inertia, plus higher Diesel power means continuous high production in every kind of digging.

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As an example of LAY-SET service:—on the Paige dragline (shown on the second level) LAY-SET Preformed gave 384 working hours of service—as against the nearest competitive rope performance of 244 hours.

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This report of increased service is typical of LAY-SET Preformed performance. We have scores of similar service reports in our files from practically every industry. If you are looking for longer service, specify LAY-SET Preformed.

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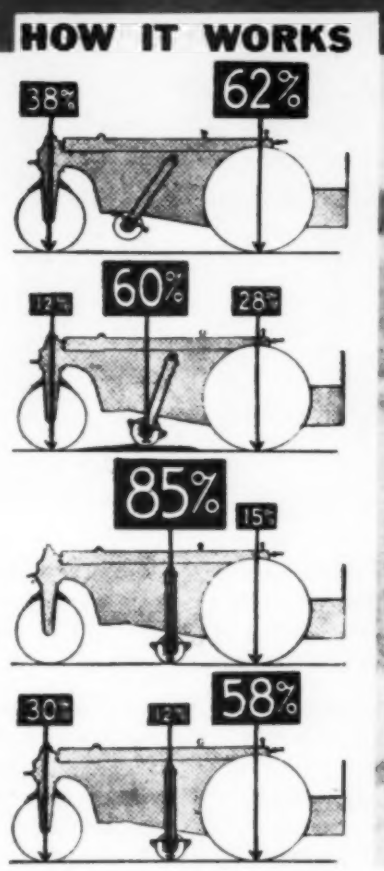
ALL HAZARD WIRE ROPES MADE OF IMPROVED PLOW STEEL ARE IDENTIFIED BY THE GREEN STRAND

Roll-A-Plane

A MACHINE THAT IS REVOLUTIONIZING ROAD ROLLING METHODS



● Experience during the past two years shows that the use of the Roll-A-Plane for bituminous materials results in a finished surface varying less than one-eighth of an inch under a 10-foot straight edge.

Here are the reasons: As shown above, the machine first goes on the job as a conventional roller to get compaction. Then the center roller is immediately dropped into position and the wavy surface developed by the usual rolling action is ironed out.

While the binder is still in a plastic condition, the center roller finds the high spots and by a tremendous spot pressure, it forces the excess of material into the nearby voids. The high spots are removed; the material relocated where it is most needed—and because the binder has not had time to harden it will reseal to form a close bond of even density.

This closer compaction and the even surface of the finished job, are all accomplished at a saving of from 30% to 50% of the time formerly required, since all cross rolling is eliminated.

More and more states are writing specifications which call for closer tolerances on asphalt highways. Write for your copy of "The Roll-A-Plane Process." It explains the use of these machines from base course to wearing surface. Your name and address will bring it to you without cost or obligation.

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a NEW NAME and
IMPROVED FORMULAS
for semi-gelatin type explosives

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ATLAS GELODYNS offer, to a high degree, the advantages of bulky ammonia types with those of the dense plastic true gelatin dynamites. Atlas Gelodyns represent a midway combination of some of the virtues of these two types that proves valuable in many operations.

New Atlas manufacturing developments have produced improved Atlas Gelodyns. They are more bulky than true Gelatin types and the user benefits by higher cartridge count. Their high cartridge strengths thus effect economies in use. The high moisture resistance of Atlas Gelodyns makes them suitable for wet locations where ordinary dynamites could not be effectively used. They are sufficiently plastic to be retained when pressed into upward pitching boreholes.

The properties of Atlas Gelodyns suggest their advantageous use for many highway, construction and mining jobs. Let the Atlas representative tell you more about these improved semi-gelatin explosives.

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ATLAS
EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

He TIMED *his* FUSE *for* 100 YEARS

THROUGHOUT the ages there have been those who refused to accept the status of their times —who placed the welfare of mankind above personal gain, and determined that the fruits of labor should not be death or disability.

Such was William Bickford, inventor of Safety Fuse. He was a leather merchant—and philanthropist —in Tuckingmill, Cornwall, England. His labors among the Cornish miners brought to him a growing realization of the tragedy of their lives; instilled

1836: Straws, and a train of powder

in him a determination to *find a way* to lessen the dangers of blasting.

In those days, blasting was done with gunpowder ignited by fuses made of wheat straws or goose quills, nested together and filled with fine powder. Such makeshifts were obviously unreliable, and too often resulted in premature explosions. Mr. Bickford experimented with these, and also with tubes of paper and leather without satisfactory results.

One day he visited a rope maker in Tuckingmill, and walked with him along his rope walk. As he watched the man twist the rope, it occurred to Mr. Bickford that if a funnel filled with gunpowder could be so fixed as to pour a stream of powder into the center of the twisting strands, and if these strands could be securely fastened and waterproofed, it would provide a slow-burning fuse. After many experiments he succeeded, and in 1831 obtained a Royal Patent for "Miners' Safety Fuse." That same year the firm of Bickford, Smith and Davey was formed and began the manufacture of Miners' Safety Fuse at Tuckingmill.

IN 1836 this new industry in an old country stretched forth its arm to assist an old industry in a new country. The Copper Hill Mine, located within the original boundaries of Simsbury, Connecticut, is recognized as the first copper mine in America. During the Revolution and for several years thereafter the mine was used as a prison, and became known as "Old Newgate." About the year 1830 a group of capitalists took over the property and organized the

"A Way must be found . . ."

Phoenix Mining Company, engaging Richard Bacon of Simsbury as superintendent.

Here, as elsewhere in the mining industries, blasting was an extremely hazardous occupation. Mr. Bacon, learning of Bickford's Safety Fuse, opened negotiations with the English firm in 1836 which led to the establishment at East Weatogue, Connecticut, of an American company under the firm name of Bacon, Bickford, Eales & Company; and manufacture was started with machinery sent over from England. Following a fire, a newer plant was established on a small water-power site nearby, and manufacture was continued.

The early fuse machinery consisted of a spinning bench with traveling "jennies" which drew and twisted the yarn for a distance of about 60 feet. Powder was fed to the center of the twisting strands; and the 60 ft. lengths were then "countered" and coated with waterproofing compounds.

One is impressed with the hardihood of these pioneers. Viewed in the light of present-day continuous methods, with precision machinery, automatic controls and fire prevention facilities, the early rope walk system seems crude. Yet it produced a slow-burning fuse which quickly supplanted the dangerous straw and goose quills, and turned a fateful operation into one of comparative safety.

ONE August day in the year 1839, a family of five left Hartford, Connecticut, in a heavy wagon, surrounded by their worldly possessions. Their destination was East Weatogue, more than ten miles away over the hills—the end of a 3,000 mile journey from England.

As they came to the top of the high hill overlooking the tiny village, their

Along the Rope Walk came Safety Fuse

journey was cut short by the breaking down of the wagon. The weary travelers alighted and took their way down to the village. And thus it was that Joseph Toy, his wife and three children completed a tedious six-weeks' journey from England.

Mr. Toy was a young bookkeeper sent to America by the English firm to represent their interests in Bacon, Bickford, Eales & Company. He never returned to England, but became an American citizen, and established an industry with which his family has been actively identified for four generations.

A Long Journey Ended — Another Begun

TWELVE years passed — difficult years, with progress gained against opposition within and without. Joseph Toy had become a junior partner in the concern, having purchased the interest of Joseph Eales who had retired; but his position was not an easy one, and it is evident that matters reached a crisis in March 1851.

"P. S. The mill was entirely destroyed by fire . . . "

A terse postscript to a letter he had previously written to the partners in England reads:

"P.S. The mill was entirely destroyed by fire this morning. Everything is consumed but the wheel—all our books and papers are gone—what a misfortune!"

The fire marked the turning point, however, for a new dawn came with the establishment, in May, 1851, of the firm of Toy, Bickford and Company. A factory was built on the present site at Hop Brook in Simsbury, and the first fuse was sent to Boston on June 14th. By the middle of July, Mr. Toy reported to his English partners that things were—

"progressing well — new concern sold fuse to end of June about $3,500. By dint of management we have the names of nearly all our old customers on our new books. My handwriting has done more than ten traveling agents could do."

The New Secret Process

YEARS moved by. A growing America was demanding greater industrial production. New problems faced the Safety Fuse industry, calling for new methods of manufacture. The days of the old "spinning jenny" were fast drawing to a close.

Joseph Toy recognized these needs, yet hesitated to adopt new and speedier methods. Even in those days Bickford Safety Fuse was noted for its uniform dependability. Its manufacture, like its operation, was *slow but sure.* For this reason many miles of fuse were made and tested in secret before Mr. Toy was satisfied that the new "continuous process" machines would be able to meet his exacting standards.

From then on the business grew rapidly. The company was able to improve quality, increase output, lower prices. In 1863 Mr. Toy's son-in-law, Mr. Ralph H. Ensign, entered the business, followed in 1871 by another son-in-law, Mr. Lemuel S. Ellsworth. In 1887 Mr. Toy died, and the firm name was changed to Ensign, Bickford & Company. In 1907 a consolidation with the Climax Fuse Company, of Avon, Connecticut, took place, the new firm being incorporated as The Ensign-Bickford Company.

A quotation from a letter written by the English partners to Mr. Toy gives a clue to the policies that have shaped the destinies of the Fuse Industry in America:

"We are assured of an important fact—that the superior quality of the fuse is your sheet anchor."

Four generations of fuse manufacture by four generations of fuse manufacturers have established standards that are *checked and double checked*—

Check — and Double Check

nothing is left to chance. For Safety Fuse must ever be dependable.

As we stand on the threshold of a new century we are grateful: for the past, which one hundred years ago gave us a firm foundation; for the present, which brings us tangible evidence of the confidence of our customers; and for the future, which will bring new opportunity.

Upon request we shall send you, free, a copy of our new Centennial Booklet, giving a more detailed history of Safety Fuse, and describing its brands. The booklet will be available about the middle of May.

Sixty-seven buildings with a total of forty-two acres at Simsbury and Avon, Conn., devoted to the manufacture of Ensign-Bickford Safety Fuse and Cordeau-Bickford Detonating Fuse. Safety lies in skill—skill in manufacture, skill in use. We do our part well.

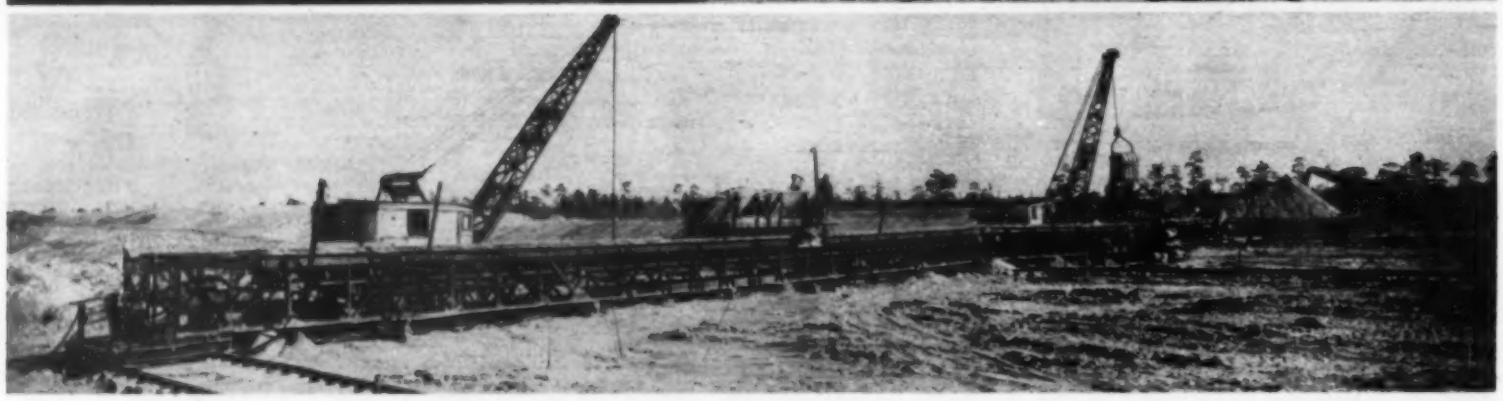
1836 BEGINNING A NEW CENTURY 1936 · ENSIGN-BICKFORD SAFETY FUSE ·

THE ENSIGN-BICKFORD COMPANY

Simsbury, Connecticut

ENSIGN-BICKFORD SAFETY FUSE CORDEAU-BICKFORD DETONATING FUSE

Making the Dirt "FLY"



Establishing Low Yardage Costs on Large Earth Moving Projects

● The ability of this Link-Belt system, equipped with swinging stacker, to handle large yardage at an extremely low cost has again been demonstrated — this time on the Florida Ship Canal Project. (First letting — 2,000,000 cu. yds.— Harvey-Ray-Noonan Construction Co.)

Dirt is excavated by Link-Belt draglines and delivered to the portable belt conveyor system, which distributes it to spoil-pile along the sides of the canal. Half of the width of the canal is excavated at first; and the other half on the return trip of the conveyor system.

We shall be glad to give you facts and figures on this and other Link-Belt earth handling installations. Address

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Exterior walls, frame, ornamentation, floors — everything of concrete is the construction method fast gaining wide acceptance. More and more buildings are being designed for Architectural Concrete because it combines beauty, fire-safety, permanence and economy.

Important schools, churches, commercial buildings, factories and apartments will go up in your community this year and many will be architectural concrete. The men who buy buildings are being familiarized with the advantages through national advertising in such magazines as *Fortune* and *Business Week*.

There is profit in these jobs for you. Are you prepared to bid on them? The latest construction technique is explained in Information Sheets and in *"Forms for Architectural Concrete,"* 64 pages of data on equipment, methods, details and material selection.

Architectural Concrete

Progress photo of entrance. Plaster waste mold over doorway kept in place while work is completed to protect base relief. At right, curved wall with forms still in place over grille.

Top: *Hollywood High School Science Building. Marsh, Smith and Powell, architects. R. H. Annin, supervising engineer. Sarver and Zoss, contractors — all of Los Angeles.*

PORTLAND CEMENT ASSOCIATION
Dept. A5-16, 33 W. Grand Ave., Chicago, Ill.

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☐ Forms for Architectural Concrete
☐ Information Sheets on specifications and other details (AC series, 1 to 12)

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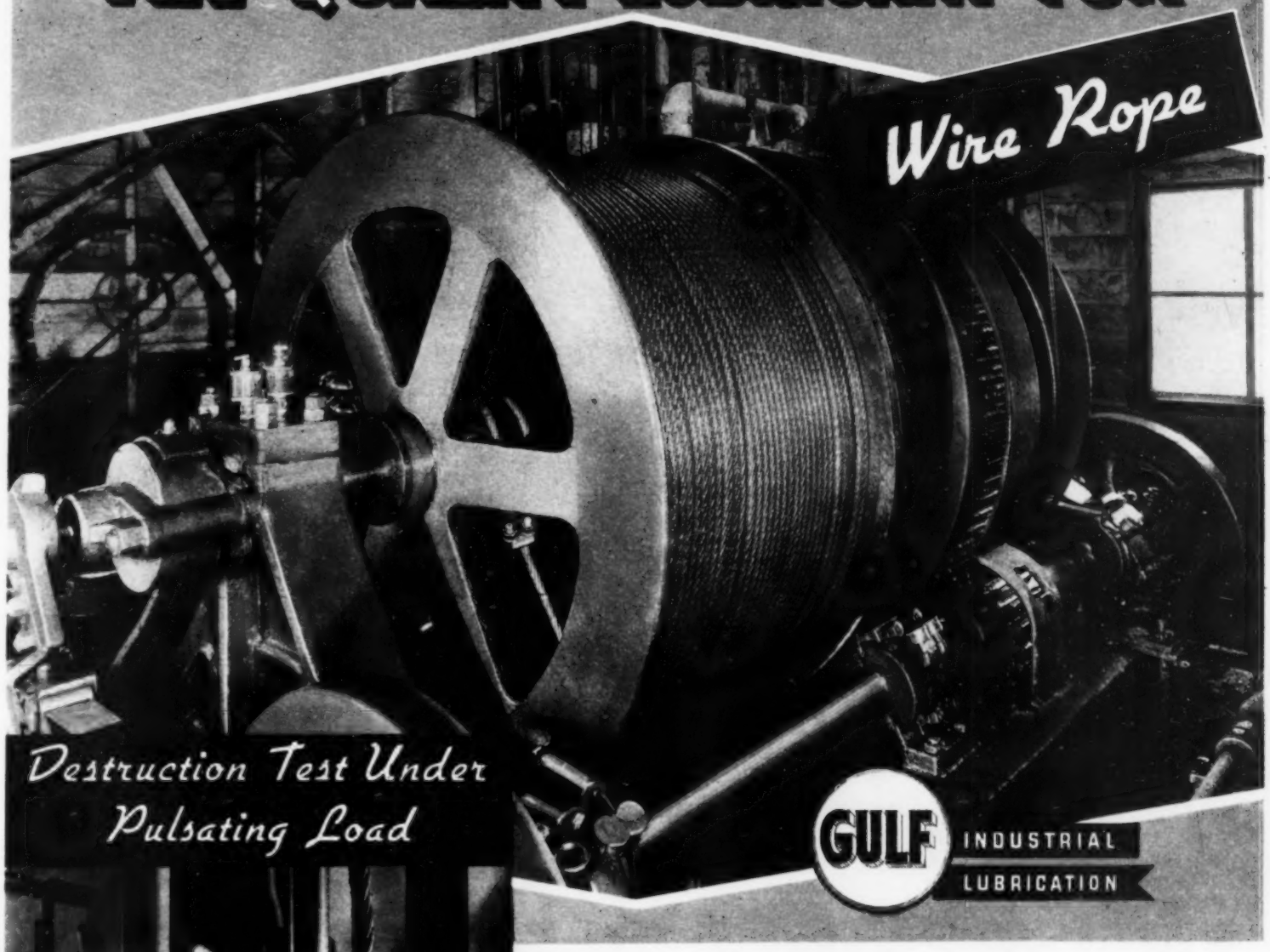


Destruction Test Under Pulsating Load

In Gulf's modern research laboratory wire rope is tested in the pulsating tensile testing apparatus shown above. Thus, Gulf scientists get first-hand knowledge of causes of cable failure and how to improve its resistance to fatigue by the proper use and application of the correct grade of Gulf Lubcote.

Leading contractors state that *Gulf Lubcote* has more than doubled the life of wire rope

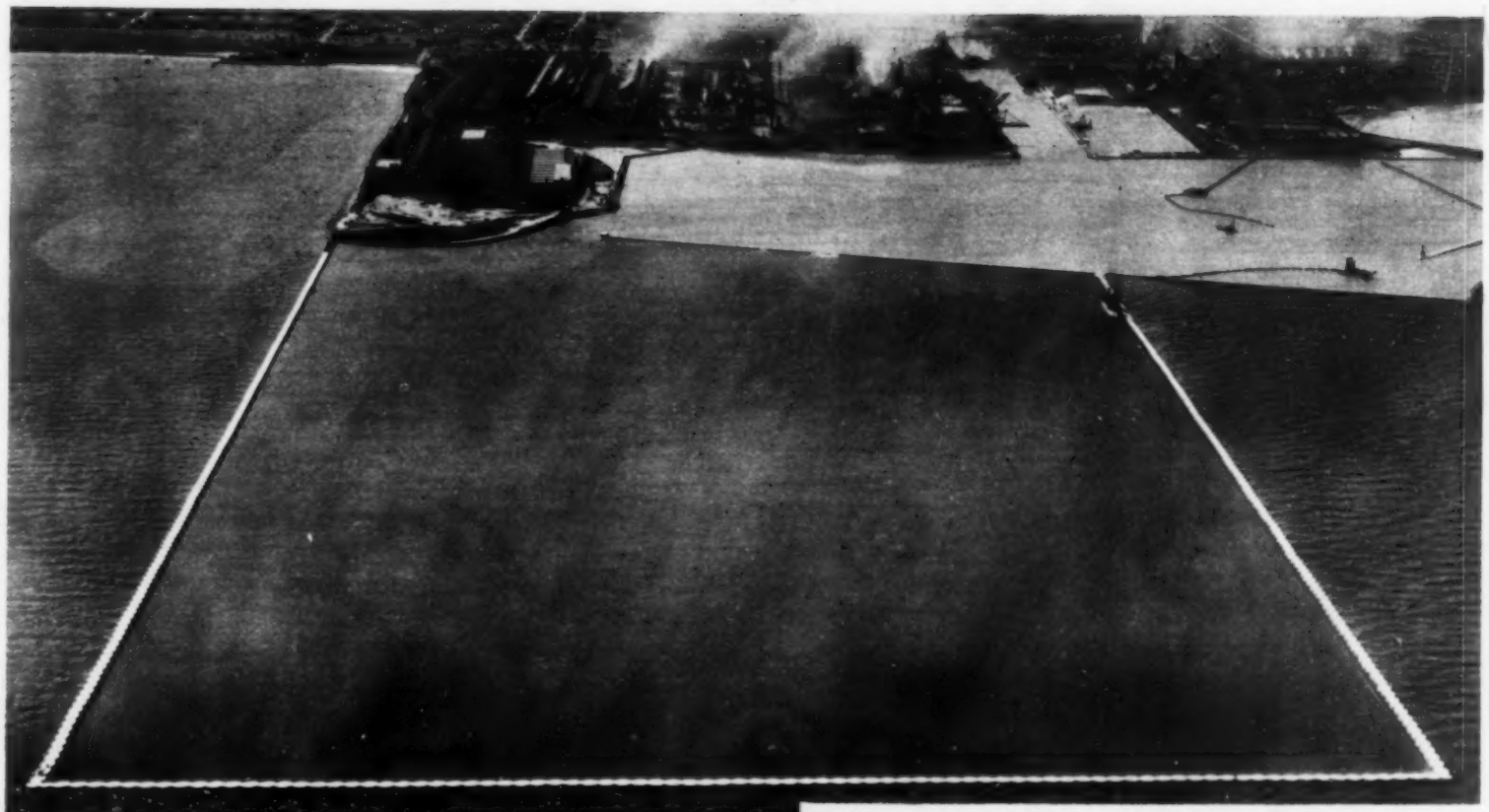
NOW CONTRACTORS can use a petroleum product which will greatly increase the service life of wire rope—Gulf Lubcote.

This product has been developed after exhaustive experiments to determine the best type of lubricant to give wire rope lasting strength under continual stressing and slackening. It is made in six grades to meet every operating condition.

Many contractors are putting Gulf Lubcote to work, with excellent results. Ask the Gulf representative how the use of Gulf Lubcote can save you money.

GULF OIL CORPORATION OF PENNSYLVANIA
GULF REFINING COMPANY, *General Offices, Gulf Bldg., Pittsburgh, Pa.*

Makers of That Good Gulf Gasoline and Gulflube Motor Oil



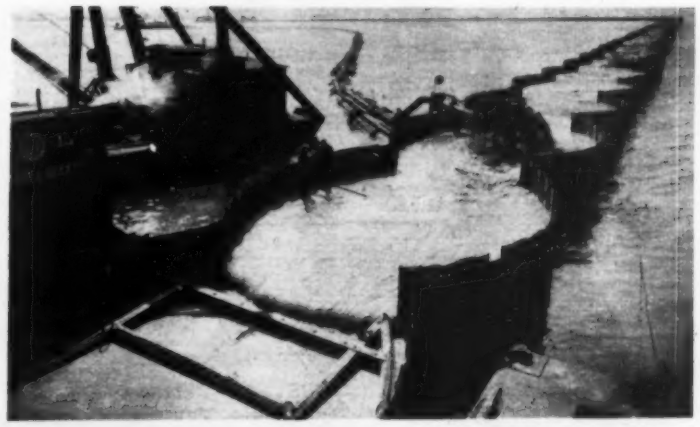
• View of completed seawall—Inland Plant in background
Great Lakes Dredge & Dock Co., contractors.

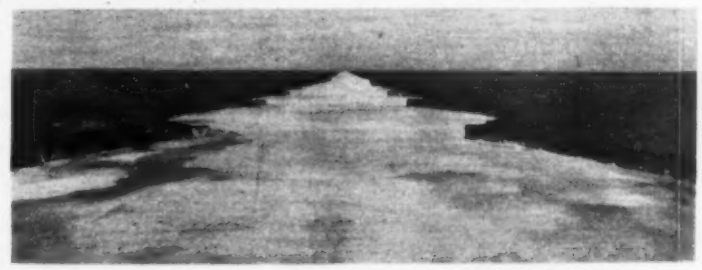
Longest Seawall of Inland Piling

Thrown out in a huge rectangle—over 2 miles in length—the longest seawall of cellular sand-filled type in the country now shields the Government Ship Canal and the Inland Steel Company's plant at Indiana Harbor, Indiana.

It is of a type new on the Great Lakes. Over 11,000 tons of Inland Sheet Piling (Section No. I-23) were used in constructing the cells, which were then filled with sand dredged from the lake. The structure is capped with 9 inches of concrete completing a seawall of great strength and durability.

We have much experience in the production of steel sheet piling and will be pleased to work with you whenever you have a job of this kind. INLAND STEEL COMPANY, 38 S. Dearborn St., Chicago, Ill.





• Above: Seawall being filled with sand pumped from the lake bottom. Below: Closeup of finished seawall after being capped with 9 inches of concrete.

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Plates Structurals Piling
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Enclosed Gears — Anti-Friction Bearings — Heavy Duty Welded Construction—Koehring Chain Crowd, Positive Steering, Powerful Traction. The 251 is available as a Shovel, Crane, Dragline or Trench Hoe. Write for bulletin.

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Select the Rope that Fits Your Job

Continued bending and unbending of wire rope over housing drums and sheaves eventually causes breaking of the crown wires from fatigue. When bending is the primary destructive force in a particular wire rope service, a design should be selected that has the strands made up of a large number of small wires rather than a few heavy wires. When other destructive forces prevent the selection of an ideal design to withstand bending, larger sheaves should be used to render the bending less acute. We will gladly advise you of the design that will give the longest rope life in your service and also furnish tables of sheave-rope-ratios. Write today.

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Mohawk Stucco made with Atlas White Portland Cement was used on each of the 80 houses in Mott Brothers Community, Surrey Lane, Hempstead, L. I. It was supplied by C. A. DeLevante, Inc., of Rockville Centre, L. I.

All the roads and foundations too...

THERE are eighty modern houses in the beautiful development known as Mott Brothers Community at Hempstead, Long Island. Mott Brothers, who are the architects, builders and owners, not only used Mohawk Stucco made of Atlas White Portland Cement on each house but all the roads in the Community and the foundations of all houses were made with Atlas Portland Cement.

Whether you are building a road, a house, a dam or a bridge you cannot buy a better cement than Atlas or Universal nor receive more prompt or efficient service than we render. We are interested in going beyond the sale and working with you, if you want us to, whenever you have a difficult problem to solve or require special information which we may have on file. Your inquiry will be handled promptly. There's no charge, of course—it's a part of our normal service to customers.

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Universal Atlas
CEMENTS

Construction Methods

ROBERT K. TOMLIN, Editor

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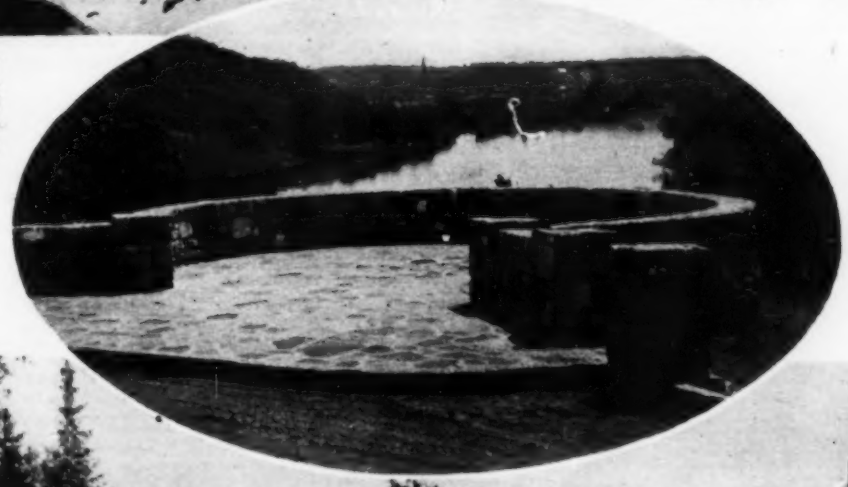
Volume 18—Number 5—New York, May, 1936

ROADSIDE IMPROVEMENTS

Enhance Attractiveness of Minnesota Highways

SCENIC OVERLOOKS *(below)* at opportune points along trunk highways are constructed by CCC or relief labor in connection with parking concourses accommodating 20 to 50 automobiles completely removed from roadway in interest of safety.



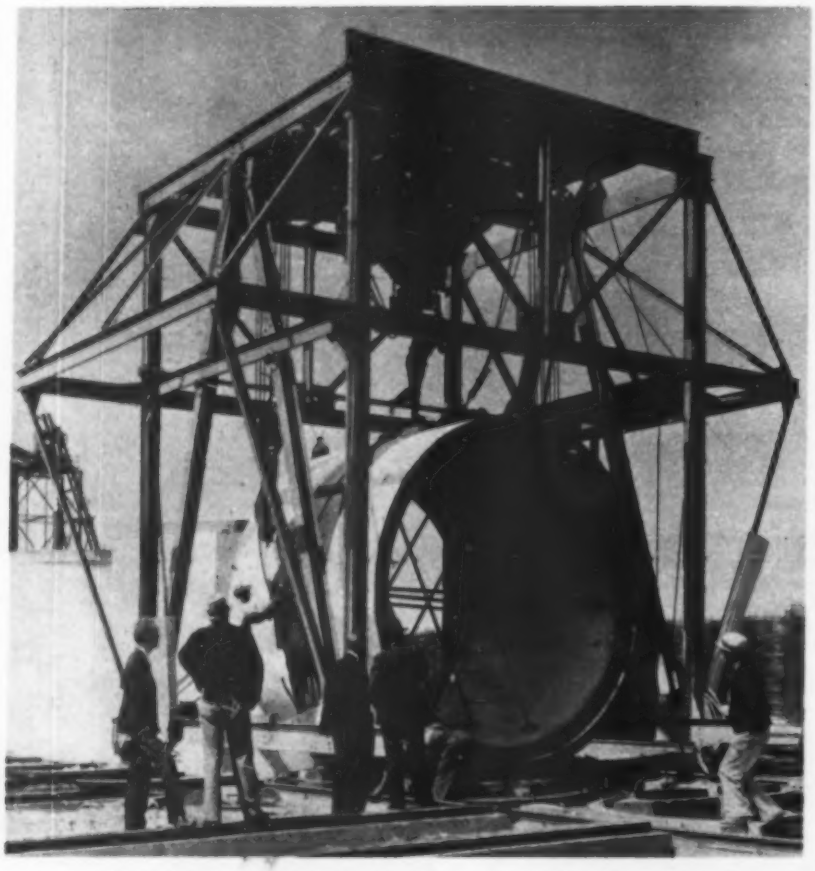
STONE MASONRY WALL and rustic guard rail made of peeled logs transform ordinary culvert into attractive structure.

HISTORIC SITE MARKER. Local organizations are encouraged to finance construction of markers of individual artistic design, replacing metal plates fastened to posts formerly erected by highway department. Parking turnouts are provided wherever possible.

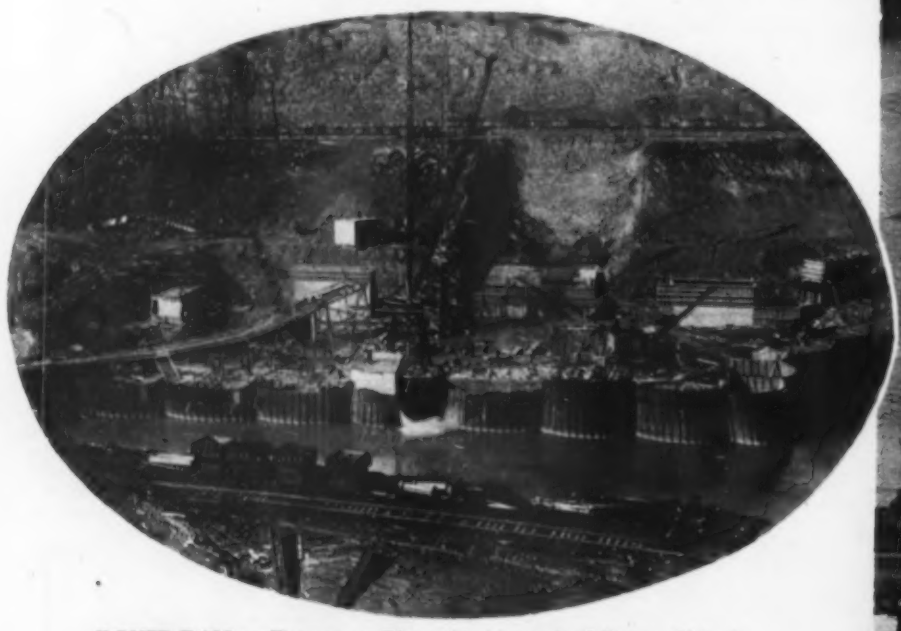
ROCK SIDE SLOPE along U. S. 61 skirting north shore of Lake Superior begins to assume appearance of natural beauty blending with forest background three months after CCC forces under supervision of State Highway Department softened vertical bank left by original construction and placed local topsoil containing seeds and roots of natural ground-cover. Another summer's growth will complete transformation.

This Month's

"NEWS REEL"



FORTY-TWO TON UNITS of precast concrete pipe, from 12 ft. 8 in. to 8 ft. 10 in. in diameter, are in course of manufacture for Metropolitan Water District by American Concrete and Steel Pipe Co. for shipment by motor truck to distribution system of Colorado River aqueduct in California. Steel gantries handle heavy pipe sections, temporarily braced on inside to prevent distortion during trip from casting yard to job.

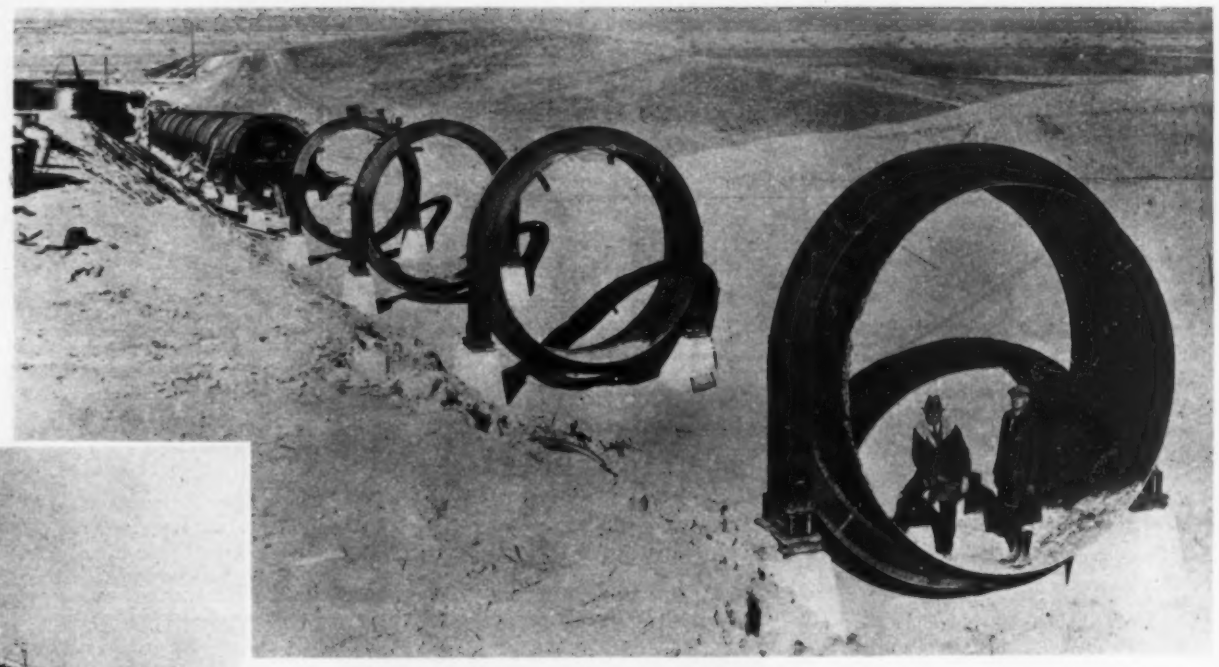


DOVER DAM on Tuscarawas River 3½ mi. north of Dover, Ohio, is only concrete structure in program of U. S. Engineers calling for 14 water-conservation and flood-control reservoirs on headwaters of Muskingum River in Muskingum Watershed Conservancy District. Thirteen other dams are being built as rolled-fill embankments. Dover dam, with crest length of 820 ft., and maximum height of 80 ft., requires 102,000 cu. yd. of concrete. Bates & Rogers Construction Co., contractor, begins operations in west half of foundation inside cellular steel sheetpile cofferdam, delivering concrete by track on trestle to two guy derricks on steel towers.

STADIUM FOR OLYMPIC GAMES is being completed to accommodate spectators viewing contests by athletes of all nations in Germany this summer. Big concrete structure surrounds arena where track and field events will be staged.

BAY BRIDGE between San Francisco and Oakland, Calif., nears completion. In foreground is latest cable-suspension portion of West Bay crossing, with main spans of 2,310 ft., connecting with tunnel through Yerba Buena Island, whence East Bay structure, in background, including 1,400-ft. steel cantilever, completes $77,600,000 traffic link to Oakland.

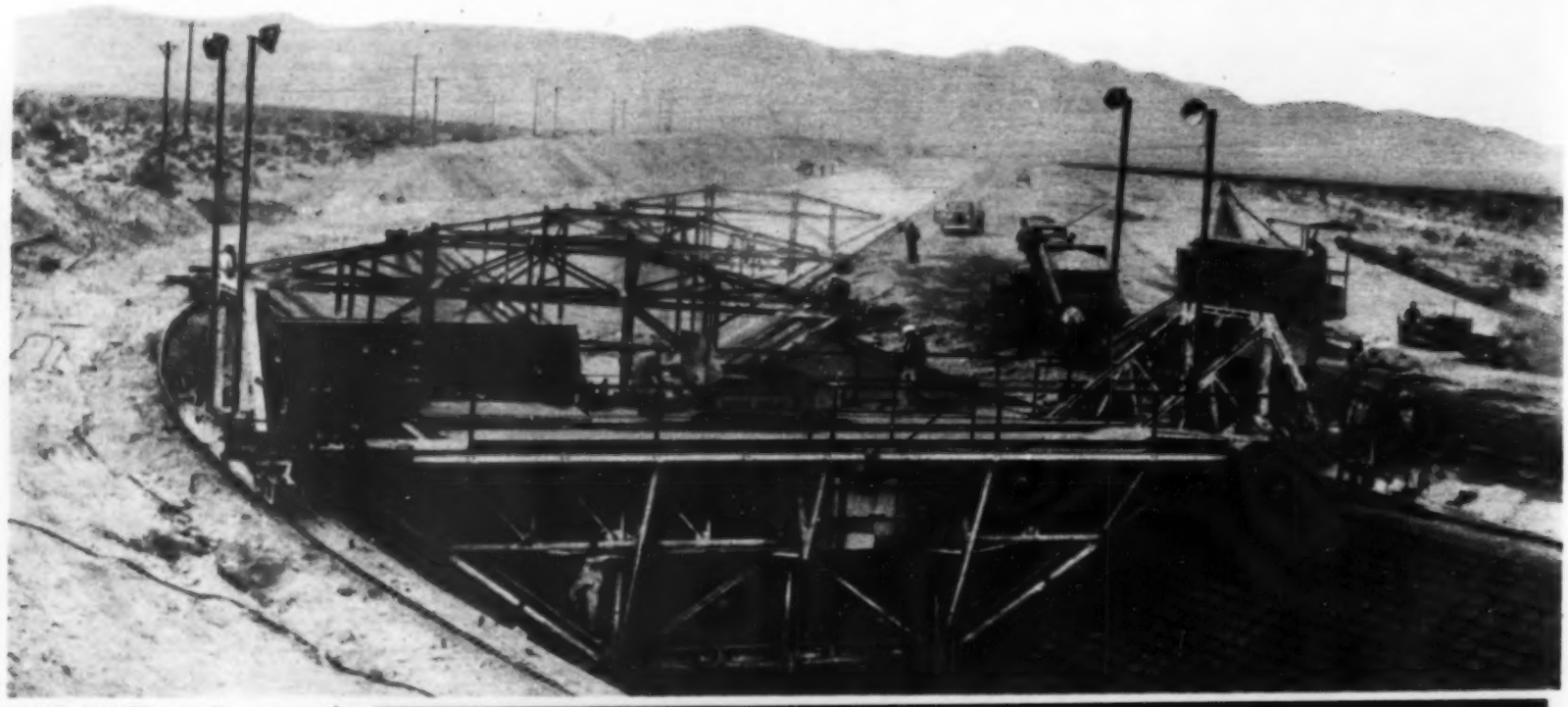
HOOPS OF STEEL *(right)*. Ring girders are being placed for big steel power conduit on $7,500,000 Platte Valley development in Nebraska, being built with PWA funds. Project includes 25,000-kva. hydro-electric plant, 220 mi. of transmission lines, two reservoirs and 75 mi. of canals for irrigation.



NEW COURT HOUSE *(below)* is completed as PWA project for Alameda County, California. Structure was financed through Federal grant of $462,000.

FINAL CONCRETING *(below)* at Wheeler dam, 1¼-mi. long TVA project on Tennessee River upstream from Muscle Shoals, Ala., consists in filling gaps left in spillway section for river diversion. With cofferdam removed, barge-mounted revolving crane, formerly used on gantry atop cofferdam wall, delivers batches in buckets from floating mixer plant.

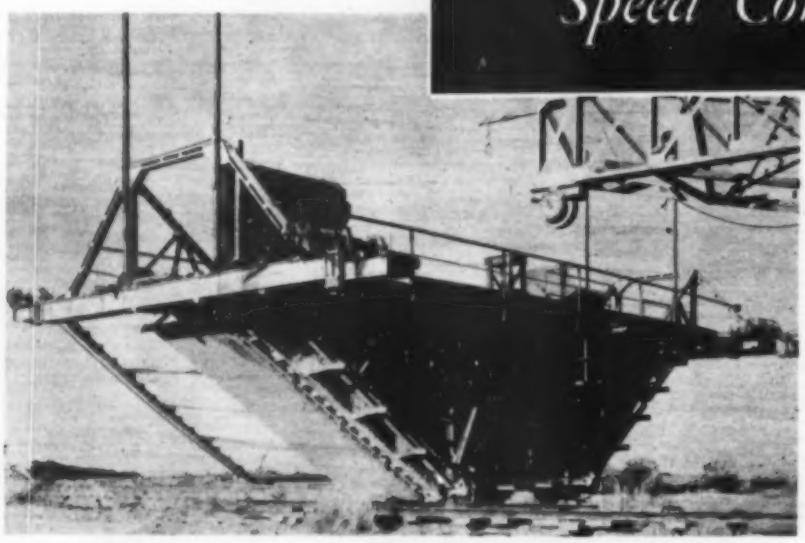
SAN GABRIEL DAM NO. 1, in California, takes form according to modified plans calling for placement of 9,000,000 cu. yd. of earth and rock fill. Height, 300 ft.; crest length, 1,670 ft. Contractor, West Slope Construction Co. Redesigned structure, on which work was suspended in 1934, is being built for Los Angeles County Flood Control District, C. G. Howell, chief engineer.



CANAL PAVER traveling on steel rails laid on canal banks places and finishes monolithic concrete-lining on bottom and side slopes, covering steel reinforcement already in place. Three rolling scaffolds behind paving unit are used by workmen troweling concrete surface.

Subgrader and Concrete Finisher

Speed Construction of Large Canal



RAISED OUT OF TRENCH on to level ground, canal paving unit reveals vertical concrete feeding hopper and slip form which smooths surface of freshly placed concrete.

AMONG the diverse types of mechanical equipment used in the construction of the open-canal section of the Colorado River aqueduct, being built by the Metropolitan Water District of Southern California, two machines in particular excite the interest of the visitor. These are a subgrader and a concrete finisher developed under the direction of Clyde W. Wood, of Wood & Bevanda, general contractors, Stockton, Calif., to trim the rough canal section excavated by large draglines to the exact line and grade required for bottom and side slopes of the canal and to place the reinforced-concrete lining 6 to 8 in. thick. The main problem confronting the contractor in both these operations was speed, for slow progress meant high costs.

As methods previously employed were not suited to speedy operation in a canal that will have a water depth of 10.2 ft. and a top width of 57 ft., contractors for the various "schedules", or sections, of the 62-mi. length of open canal needed machinery specially designed for the work. Several subgraders and concrete finishers of different design were constructed, each having its own peculiarities. The following notes refer to the Wood equipment built expressly for the 8-mi. portion of open canal awarded to that contractor.

Sugbrader — Designed as a rigid steel structure spanning the canal, the subgrader is supported by 75-lb. T-rails set back 2 ft. on either bank from the edge of finished slope and spiked to ties. The rails are spaced 61½ ft. c. to c. Carrying the subgrader mechanism is a rigid frame supported on either side of the canal by an end truss 30 ft. long set parallel to the canal center line and fitted with double-flanged wheels traveling on the rails. Three truss members between the end trusses extend across and down into the canal. These transverse trusses hold the machine rigidly in alignment and transfer the weight to the rails.

DISTRIBUTOR CAR shuttling across top of canal lining unit takes concrete from two paving mixers on far bank and discharges it into continuous hopper between rails, maintaining uniform head of freshly mixed concrete in vertical hopper along advancing edge of machine.

Two specially designed side-digging bucket lines operating at right angles to the canal center line comprise the earth cutting mechanism. Buckets, chain links and rollers are made of a nickel alloy steel with a special hardening treatment to resist abrasion. Each bucket line, containing fourteen 1-cu.ft. buckets welded to links of the chain, powered by a 25-hp. geared electric motor, runs from a point past the center line of the canal across half the bottom and up one of the side slopes. The link rollers fit between the flanges of 4-in. channel irons hardened to resist wear. These channels, attached to the main cross trusses, hold the buckets rigidly in position to assure cutting exactly to grade even through the hardest cemented gravel or hardpan. Speed of the bucket line is 28 buckets per minute. As the forward travel speed of the subgrader is about 1 ft. per minute each bucket cuts into the face for a bite ½ in. deep. To facilitate breakdown of any stiff material encountered, every third or fourth bucket is provided with a second tooth near the top of the cutting face.

Excavated material is dumped as the buckets overturn at the top of the slope. Spoil discharged in this manner falls on a short 24-in. conveyor paralleling each bucket line, which leaves a windrow of spoil well in the clear on either side of the canal.

Behind the bucket lines is a clean-up blade set to the exact grade of the canal and effective in scraping up all material that gets by the buckets. This blade leaves the surface of the cut in a finished condition, making any trimming by hand unnecessary. Forward travel of the subgrader is controlled by a two-drum winch mounted on the front truss, about one-quarter of the way up the slope. Because the cutting edges are more than 12 ft. below the rails, producing large overturning moments as well as uplift in digging the hard materials encountered, no attempt was made to develop a self-propelling machine. The winch is driven by a 2-hp. geared electric motor and a two-part 9/16-in. cable running from the winch to a deadman and a dead-ended back on the main frame.

Travel is facilitated by a 60-hp. tractor with a bulldozer dropped into the ground to serve as the deadman. The two drums on the winch enable the operator to keep the machine squared up across the canal and to travel around the curves by disconnecting either clutch as required. With travel speed at 1 ft. per minute when the drums are empty, increasing to nearly 1½ ft. per minute when the drums are full, the advance per 8-hr. shift is from 500 to 600 lin.ft. of canal, which represents an average performance per shift of 30,000 to 36,000 sq.ft. of finished subgrade. Repeated checking has shown the surface so finished to be not more than 0.01 ft. from true grade.

Total weight of the subgrader is about 50 tons, and special provision was required to get it across inverted siphons, fourteen of which interrupt the continuity of the 8-mi. stretch worked by the machine. Each siphon crossing was accomplished by transferring the point of support of the subgrader from wheels at the top of the canal to a track of narrower gage laid on the bottom with the aid of inclined tracks installed at each end of such a stretch. As mentioned previously, the machine is operated by electric power exclusively, and only three sets of start-stop switches are required: one for each bucket line and one for the travel switch. Floodlights are available for night work.

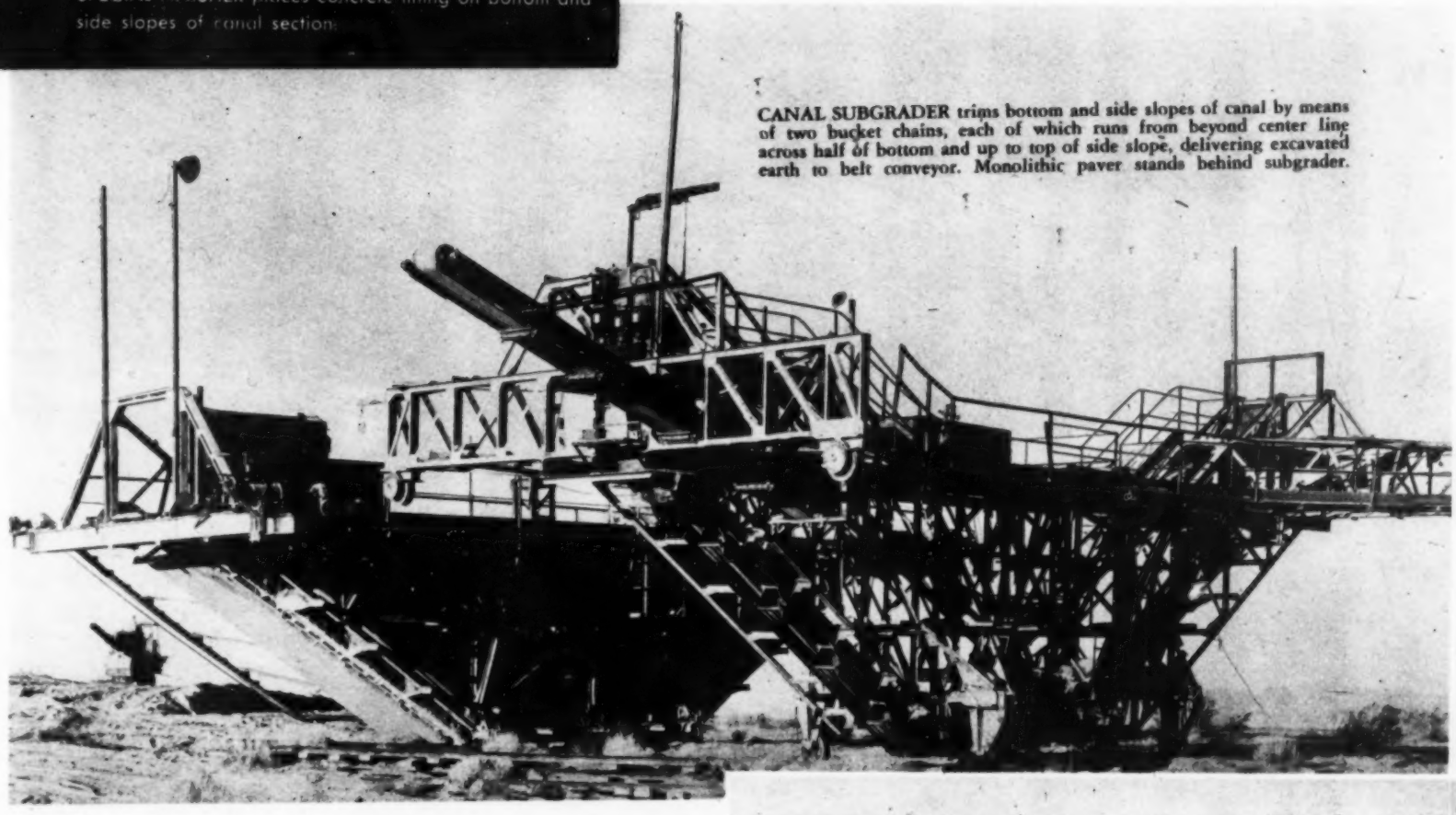
Concrete Finisher — Following the subgrader, a concrete finisher or monolithic paver places the concrete lining on the bottom and side slopes of the canal. Essentials of this operation are that the lining must be placed exactly to line and grade, must be well compacted ready for the final troweling by hand and that the work must be performed speedily and economically. A singular advantage of the finisher is that it eliminates need for construction joints longitudinally along the lines where bottom and side slopes intersect. In fact, instead of a weakness resulting from joints along these lines, the use of a short radius curve on the forms at this joint strengthens the lining here and gives the canal a smoother finish.

The finisher operates on the rails set for the subgrader which remain undisturbed between the two operations. As in the case of the subgrader,

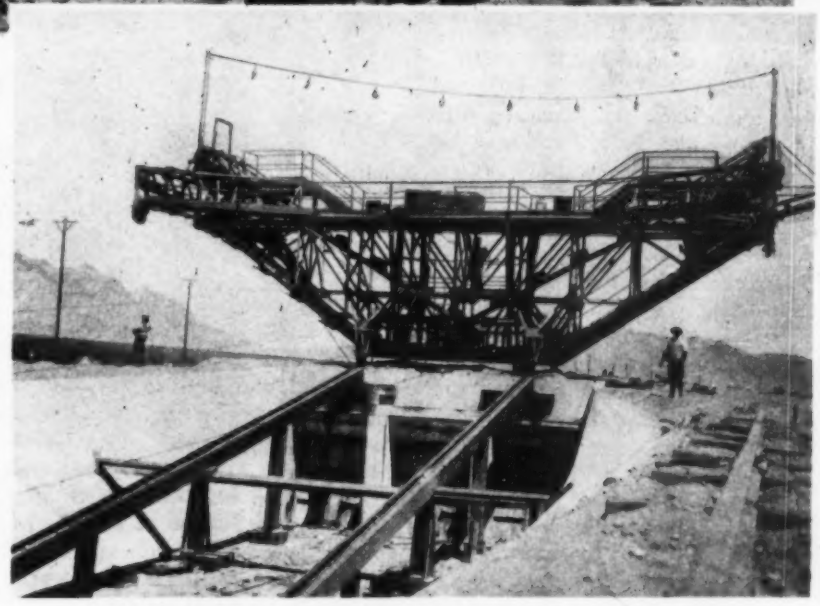
How

ACCURATE TRIMMING of bottom and sides of excavated canal section is done by mechanical subgrader.

SPECIAL FINISHER places concrete lining on bottom and side slopes of canal section.



CANAL SUBGRADER trims bottom and side slopes of canal by means of two bucket chains, each of which runs from beyond center line across half of bottom and up to top of side slope, delivering excavated earth to belt conveyor. Monolithic paver stands behind subgrader.



INCLINED TRACK rising from canal bottom assists machine across obstruction. Weight of machine is transferred from rails on canal banks to inclined track.

the end trusses of the finisher are 30 ft. long. Because of the absence of moving parts two stiff transverse trusses are sufficient to maintain the desired rigidity. These trusses support a ½-in. steel plate or slip-form whose outline corresponds to that of the inside finished cross-section of the canal. The plate is 6½ ft. long, measured along the canal center line, and its front and back edges are rolled to a 4-in. radius to avoid risk of disturbing the concrete surface as the form moves over finished work. On the bottom the plate is squarely across the canal. The plates on the slopes, however, are set on a slight angle so that the forward edge at the top is 2 ft. back of the forward edge at the bottom of the slope, as measured parallel to the canal center line. This angle or rake gives support to freshly placed concrete from below.

Concrete mixed in two standard road pavers, working in tandem on one canal bank, is delivered to a continuous, vertical hopper 18 in. wide and 2 ft. high across the advancing edge of the machine by a distributing car which moves back and forth on top of the main truss. The car keeps the hopper full and thus maintains a uniform supply of concrete along the advancing edge of the slip-form. Vertical baffle plates are set on 12-in. centers in the hopper to retain the concrete in the location where it is deposited until it feeds into the canal lining slab. To discharge concrete at all points along the cross-section without stopping the distributing car, an inclined apron serving as a continuous chute is located above the hopper on the side toward the machine. The plan of operation is to maintain a uniform head of freshly mixed concrete along the entire length of the continuous hopper and the slip-form that follows. The void between the subgrade and the slip-form is filled with concrete forced down by the pressure of the material in the hopper above.

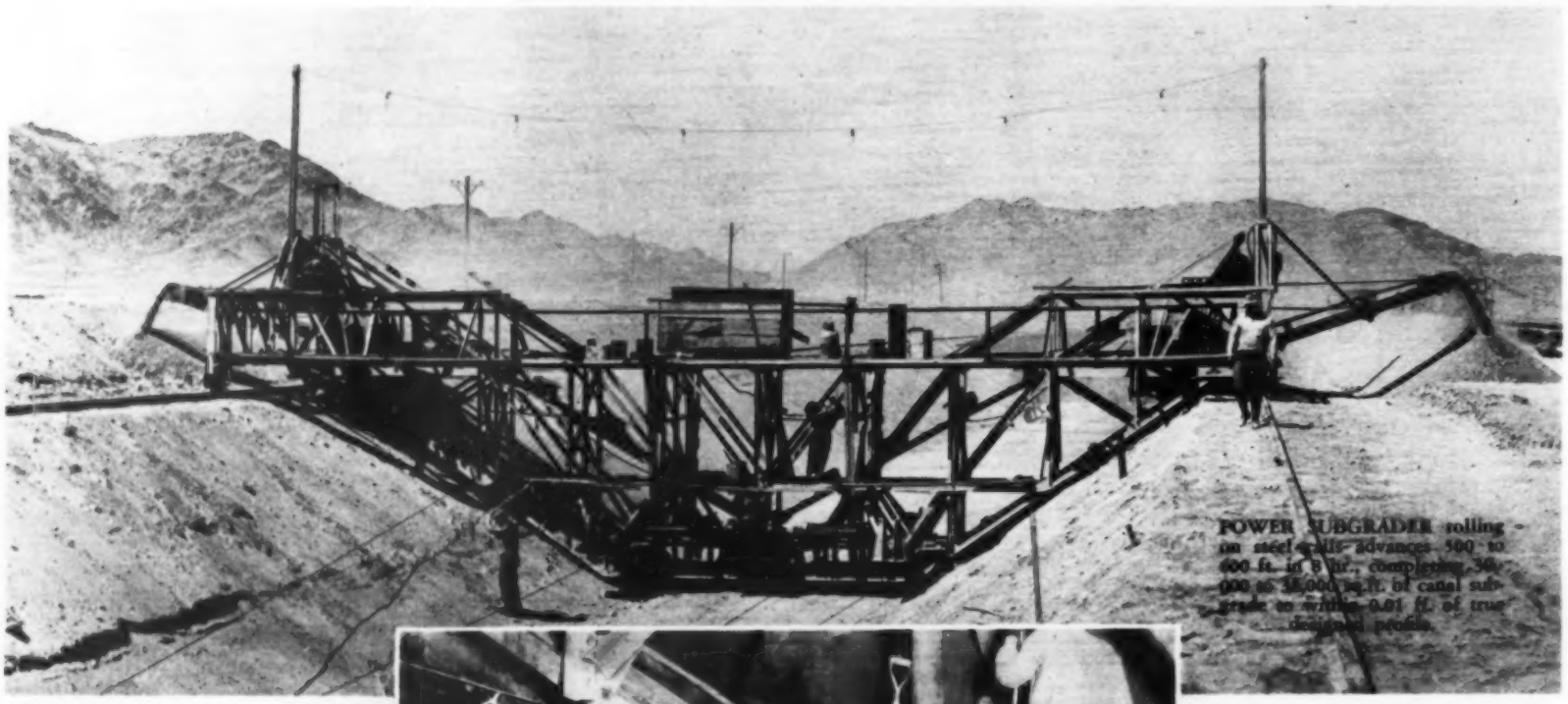
Two single-drum winches, mounted on the two end trusses and driven by 2-hp. geared electric motors, move the finisher. A two-part, 9/16-in. cable passes from the winch through a sheave secured to the rail head and back to the main frame. The normal travel speed for which the finisher is powered is 1 ft. per min.

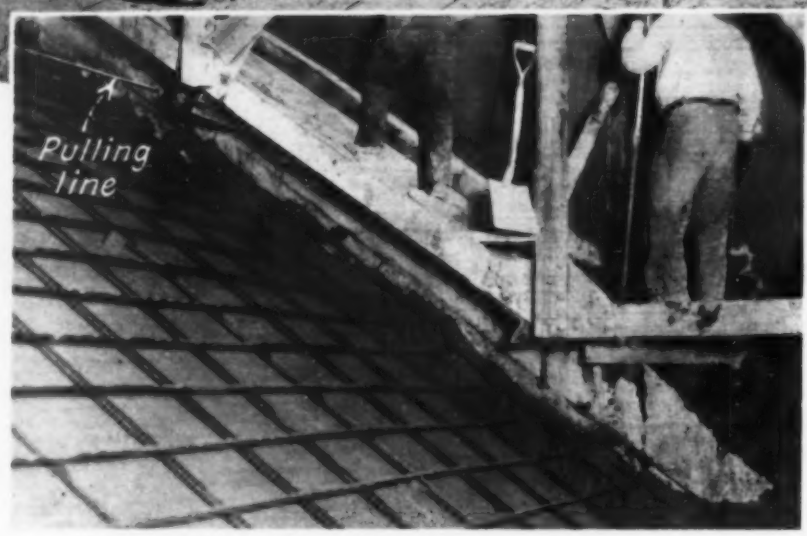
Vibration — Proper placement of concrete under the side slopes is accomplished by internal vibration. A vibrator tube 3 in. in diameter and 22 ft. long is installed on each side slope near the bottom of the hopper for this purpose. Experimental operation of these tubes showed that it was possible to over-vibrate the concrete and actually to float the 50-ton finisher on the concrete surface. The most effective vibrator speed is 2,500 r.p.m. Each vibrator is operated by a belt connection to a 10-hp. motor. Placement and compaction of concrete in the level section or bottom of the canal is done by means of external vibrators of the Syntron magnetic type vibrating the entire plate. Experiment showed that this type of vibrator was superior to the long internal vibrator on the bottom. No movement down the slope back of the slip-form is ever experienced, and concrete with a slump as high as 3 in. occasionally is used without change in the satisfactory finish of side slopes.

Use of the concrete finisher made it possible to place the entire width of canal lining without the longitudinal joints originally planned by the District's engineers. Transverse expansion joints are put in only at the end of each day's work, about 500 ft. apart. The reinforcing steel is laid on concrete chairs on the finished subgrade just ahead of the finisher. As the lined perimeter of the canal is 62 ft., the requirement is the equivalent of three 20-ft. highways placed as a single strip with construction joints only at 500-ft. intervals. Another convenience made possible by the finisher is that the men who trowel the surface have access to their work for initial troweling only a few minutes after the concrete has left the mixers. This work is done from two carriages supported on the rails alongside the canal. The carriages are light frameworks with longitudinal planks supported close to the bottom and side slopes to offer the finishers convenient access to the freshly poured concrete without placing any weight upon it. With the concrete finisher moving ahead 1 ft. per minute the customary finishing crew includes sixteen men who work from the carriages, moving them along by hand as the work advances.

Each day's work, averaging 500 lin.ft. of canal, represents 700 cu.yd. of concrete in place. Progress is limited by the capacity of the two mixers. As far as the finisher is concerned it is believed that it could place 1,000 cu.yd. with the same payroll when operated with larger mixing equipment.

Of the other methods of placement tried out on the 62-mi. open-canal job, none has succeeded in placing more than 200 cu.yd. of concrete per shift, and all have required longitudinal joints at the bottom of both side slopes as well as numerous transverse joints. The records attained by the equipment described have earned its inventor the sobriquet "Foot-a-Minute" Wood along the aqueduct. Concrete finishers similar to the Wood machine are now used on all of the lining schedules.

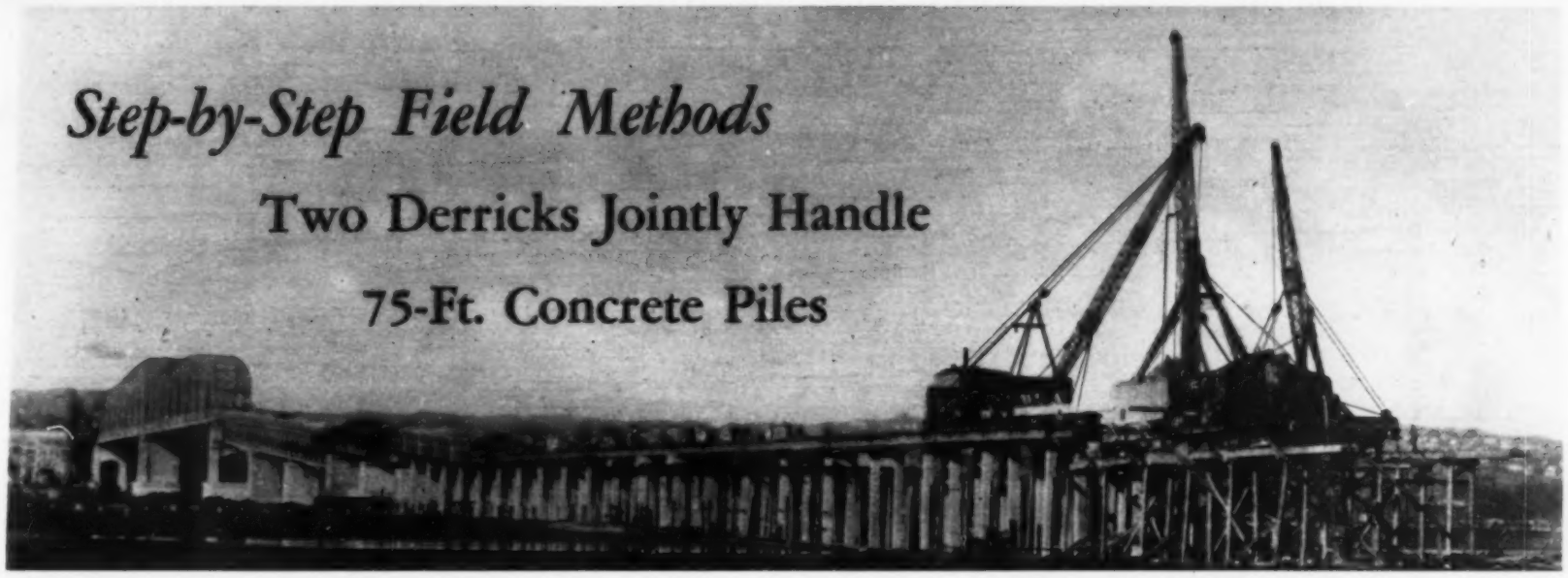




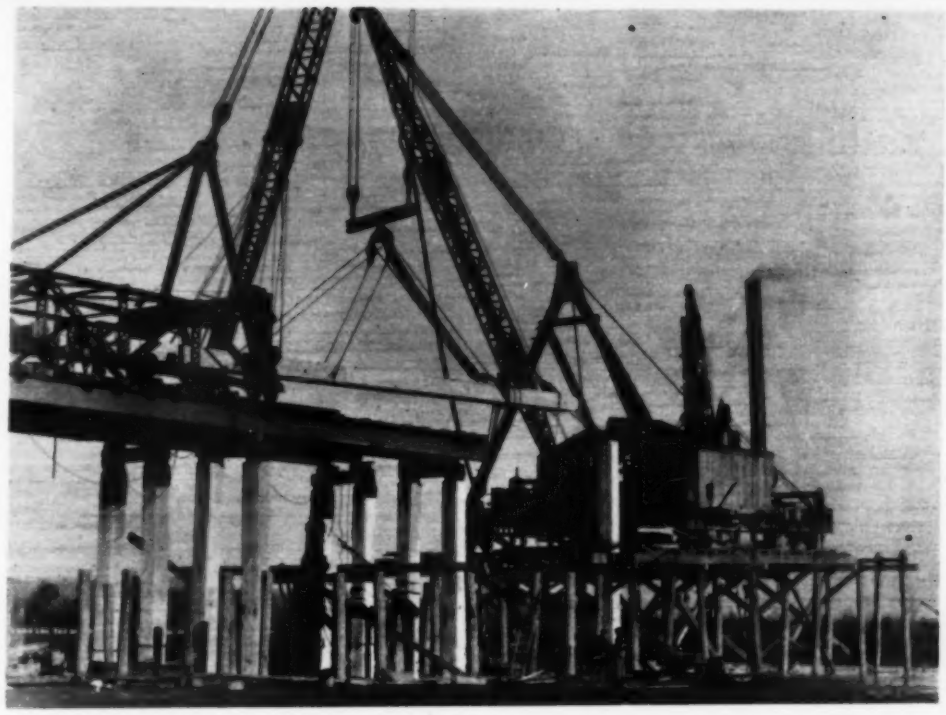
FORWARD EDGE of paver-finisher contains vertical hopper feeding concrete on to subgrade of side slopes and bottom. Pulling line is reeved through sheave and back to power winch on finisher. Long internal vibrator is installed near bottom of hopper on each side slope.

Step-by-Step Field Methods

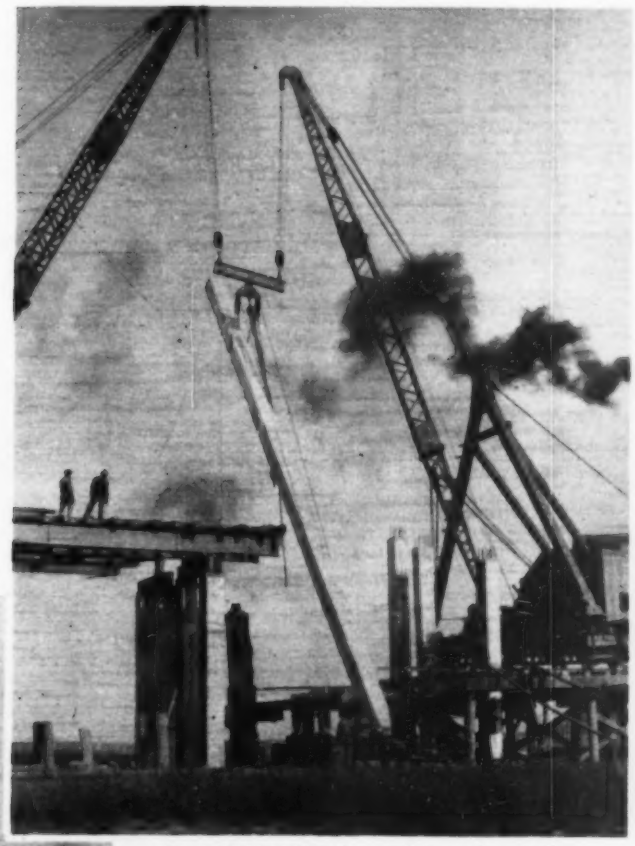
Two Derricks Jointly Handle 75-Ft. Concrete Piles



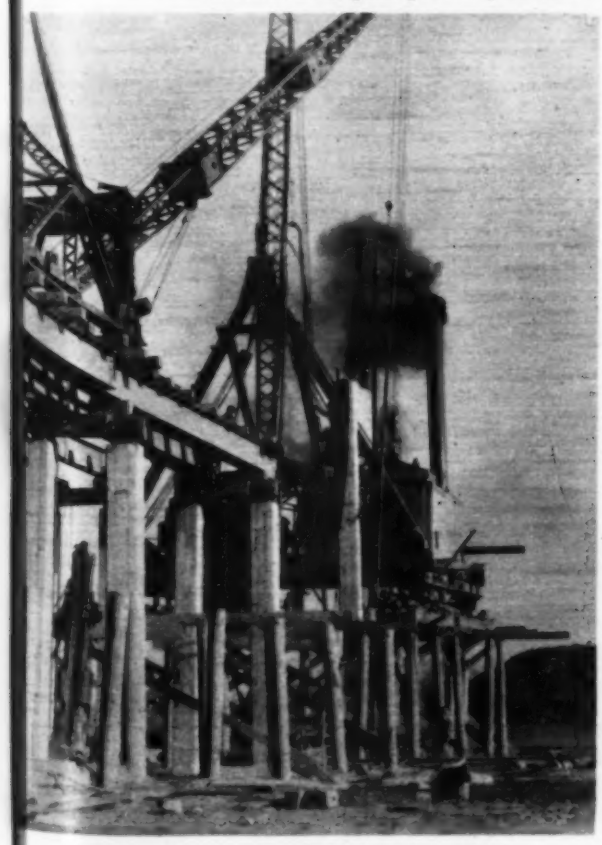
CONCRETE PILE TRESTLE, 1,050 ft. long comprising 31 four-pile bents, forms east approach to Missouri River bridge at South Omaha, Nebr., constructed by Kansas City Bridge Co., of Kansas City, Mo. Concrete piles 24 in. square and 75 ft. long, weighing 23 tons each, are cast on completed portion of bridge and transported over it on push cars.

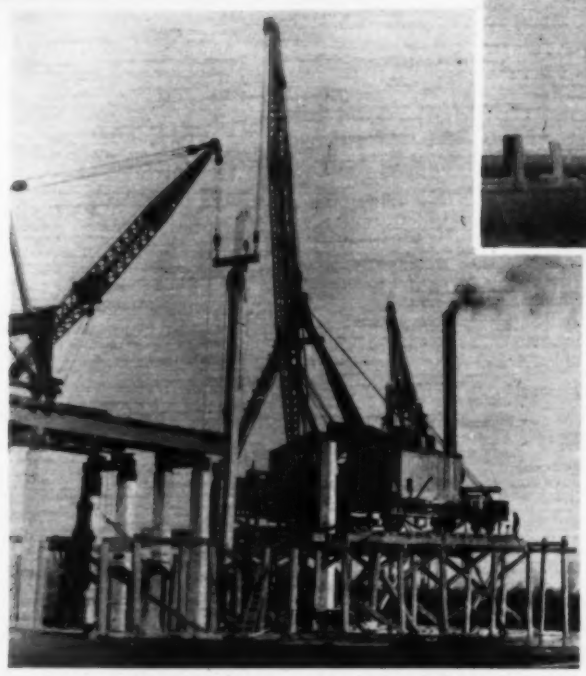


1 EQUALIZER RIG suspended from booms of two derricks, one on pile trestle and other on falsework at lower level, picks pile off push cars.



2 PILE POINT, lowered toward ground, is placed on car truck which moves it to proper location as derricks complete rotation of pile into vertical position.





3 AS PILE REACHES VERTICAL POSITION middle cable assumes entire load, permitting removal of other two cables. Pile is placed in exact position for driving.

4 TWO WATER JETS *(left)* of 400 g.p.m. each at 150-lb. pressure put pile down as far as possible in mud bottom.

5 SPECIAL FOLLOWER *(right)*, or driving cap, protects reinforcing bars protruding from butt while Vulcan 16,250-lb. hammer completes driving.

Church Tower Underpinned

By P. B. KIRBY, *Chief Engineer, Mills, Rhines, Bellman & Nordhoff, Architects, Toledo, Ohio*

CRACK in side wall caused by settlement of church tower foundations.

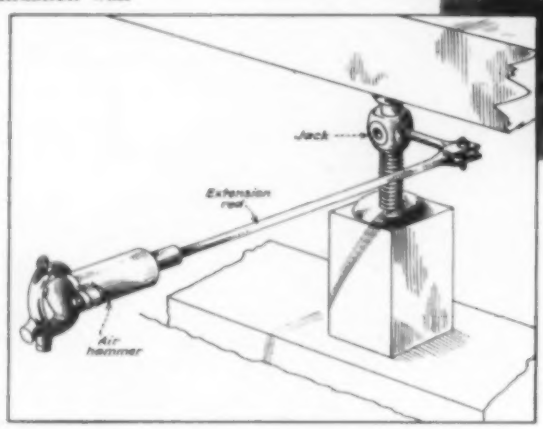
A 200-FT. BRICK TOWER weighing 2,300 tons and an adjacent wall were raised and underpinned using only 10-ton screw jacks and a crew of four men at St. Anthony's Church, Toledo, O., an old brick building with a brick tower at the center of the front wall. The structure rests on a rather soft clay which permitted the tower and front wall gradually to settle and tip forward, cracking away from the side walls at the first window on each side, as shown by one of the accompanying photographs. After being raised, the front wall and tower were underpinned with a wider foundation, reducing the load on the ground to about 2,800 lb. per square foot.

Shoring supported the walls and tower during excavation to the bottom of the footing. Openings 2 ft. wide were cut through the foundation wall and jacks were placed on the footing to take the wall load. Alternate sections were cut until all the front wall and tower rested on jacks.

Wall and tower were raised and straightened by taking a quarter turn on all jacks at each lift. Jacks at the back were turned with a long rod which had a short piece pinned to one end. The short section was placed in the eye of the jack and the jack turned by the blow of an air hammer on the long rod.

SHORING *(above)* was placed before excavation was started.

EXTENSION ROD *(below)* struck by air hammer operates jacks in back row.



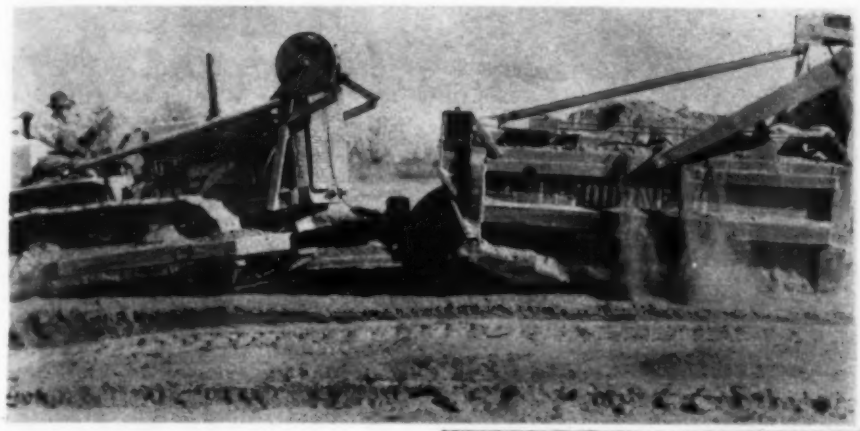
When the tower had been raised nearly to its original position a new footing was placed on each side and needle beams were cast in 2-ft. sections under the wall on the new footings.

NEEDLE BEAM *(above)* was cast under tower.

Three rows of jacks were left between beams and the beams set ten days before the adjacent jacks were removed. By tamping the concrete under the wall it was found that the beams did not shrink away from the wall in setting, and no movement was apparent when all the jacks had been removed. No new cracks developed during the work. After the wall had been on the new footings for a month the cracks in the side walls were repaired, and there has been no further evidence of any movement.

Mills, Rhines, Bellman & Nordhoff were the architects in charge of the work, and the Alexander Construction Co., of Cleveland, was the contractor. The author was the architects' engineer.

SCREW-JACKS *(below)* were set under foundation wall.



"PUSHDOZERS"

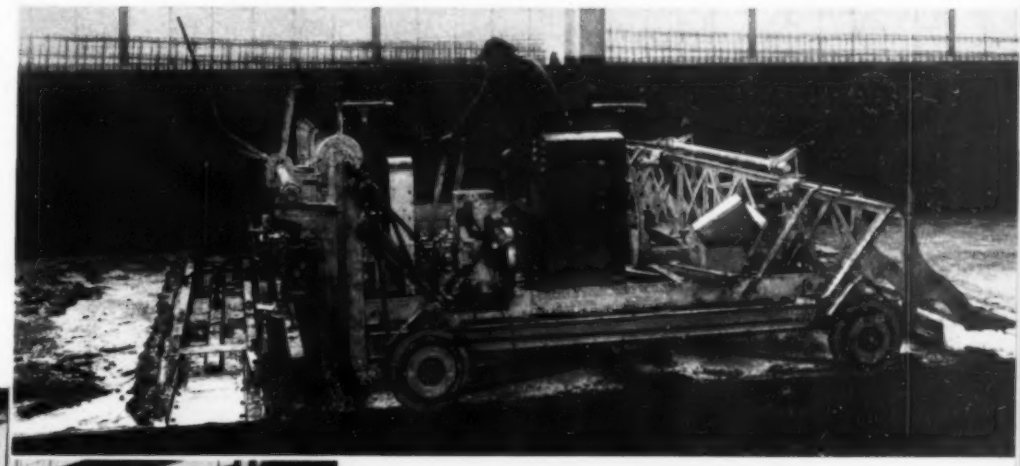
Increase Pay Loads of Carryall Scrapers

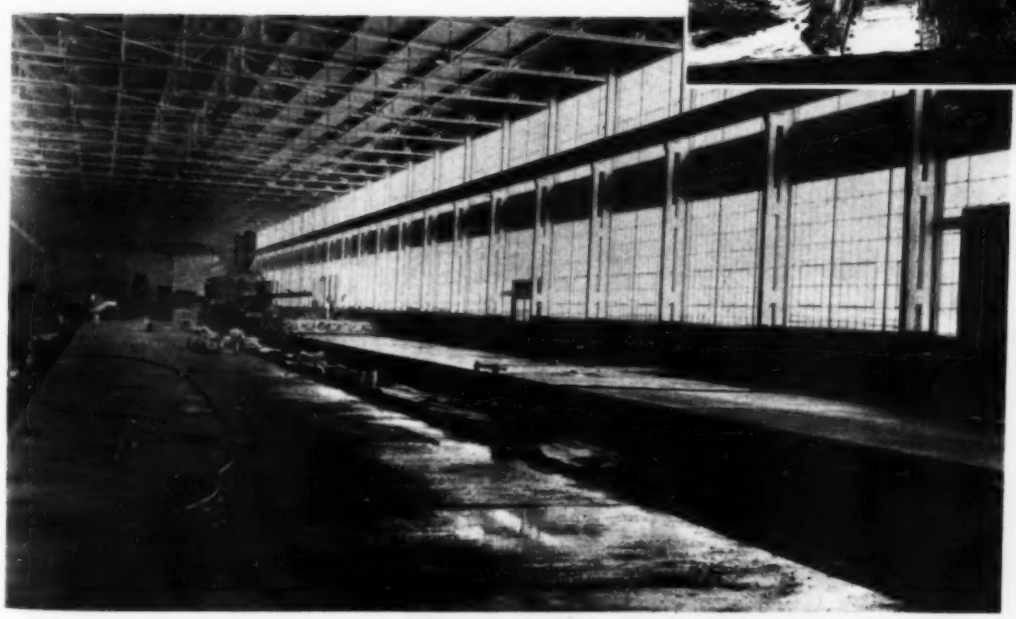
ON THEIR 430,000-cu.yd. American River levee job near Sacramento, Calif., McDonald & Bohnett, contractors, of San Jose, employed "pushdozers" to increase the loads of earth normally handled with their tractor-drawn Le Tourneau carryall scrapers. During the loading operation of the tractor-scraper outfit a second tractor, equipped with a bumper on its front end, shoved the scraper unit from behind. This had the effect of speeding up loading time, heaping up and packing the material tightly into the scraper bowl and increasing the pay load per trip to 9 cu.yd. as compared with a rated capacity of from 8 to 8½ cu.yd.

REAR-END PUSH by tractor with bumper *(above, left)* completely fills bowl of scraper on levee job.

De-Airing Screed

Finishes Concrete Floor



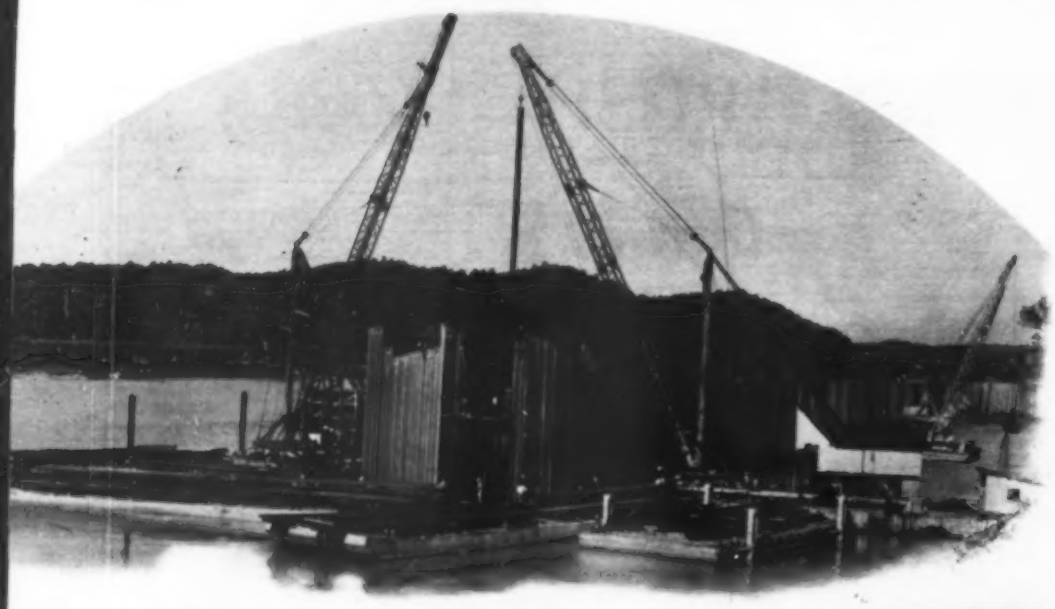


CONCRETE FLOOR in industrial building is finished by multi-purpose machine *(right, above)* that de-airs, vibrates and levels off concrete and installs joints

EQUIPPED with a new de-airing screed attachment, in addition to a mechanically vibrated screed and joint installation devices, a Flex-Plane machine, designed primarily for highway paving service, was employed by the Heller & Murry Co., contractors, to finish a large area of concrete floor within one of the new buildings of a large steel plant in Youngstown, Ohio. The flooring consisted of four 18-ft. and one 15-ft. concrete slabs, all reinforced with steel mesh and having a uniform thickness of 5 in.

The attachment for increasing the density of the concrete by de-airing consists of a flat screed with cavities in its under surface which are tapped by a flexible hose line connected to a vacuum pump. With the combination of de-airing and vibrating equipment on the finishing machine it was possible to employ a dry concrete with a ratio of only 4.4 gal. of water per sack of cement. The Flex-Plane machine was equipped for both forward and backward screeding and was adjustable for handling both the 18- and the 15-ft. slab widths.

Three-Stage C
Planned for B
TVA's Pickwick L



FLOATING DERRICKS are used in driving steel sheetpiling for cellular cofferdam for lock structure.

PICKWICK LANDING DAM, in Tennessee, third in the series of great construction projects undertaken by the Tennessee Valley Authority, has been carried forward with unusual dispatch on a force account basis under a combination of physical conditions somewhat different from those encountered on any of the other major jobs that the Authority has under way.

As summarized in a previous article (*Construction Methods*, September, 1935, p. 46) Pickwick Landing dam is being built across the Tennessee River about 206.7 mi. upstream from its confluence with the Ohio. At the site the channel of the river is between two well-defined banks rising about 40 ft. above the bed of the stream. A flood plain, 4,700 ft. wide, extends from the left bank to higher ground, while one that is about 1,100 ft. in width lies between the right bank and a hill on that side of the valley.

Essentially, the project involves a concrete spillway, 1,155 ft. in width, that will occupy the entire channel of the stream; a navigation lock at the left end of this spillway structure, with an earth embankment containing about 1,235,000 yd., of which 1,118,000 yd. will be placed by hydraulic-fill methods across the flood plain on that side to the higher ground. At the other end of the spillway is a powerhouse structure, with a rolled-fill embankment finishing out the project between it and the hill on the right side of the valley.

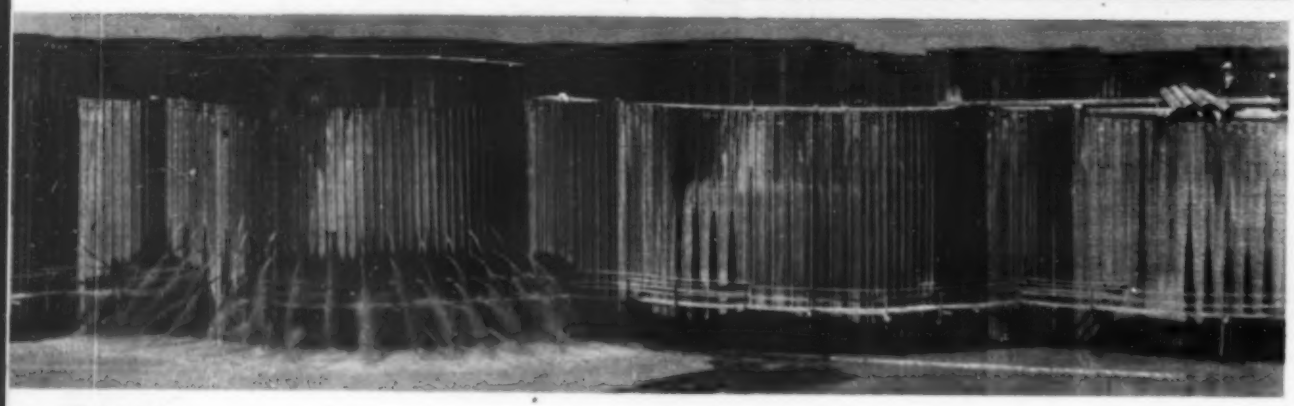
Stream flows of record at the site range from a minimum of about 4,000 to more than 300,000 sec.-ft. High water usually comes between the end of November and early spring, although high summer stages have been recorded. A wide variation in duration of high and low flows occurs, both annually and in cycles. With few exceptions it is possible to count on low water from September to December.

Three Construction Stages — Based on these records the construction program has been divided into three stages. The first stage includes the completion of the two embankments and practically all of the 110x600-ft. lock chamber. The second stage takes in all of the power house and about 200 ft. of the total length of 1,155 ft. in the spillway structure. The final stage will complete the spillway and lock.

Construction was started in March, 1935, when the general features of the project had been fully determined, but many important details of design remained to be completed. Schedules provided that the two embankments were to be completed to their full height and a cofferdam inclosing the site of the lock chamber was to be unwatered before the usual beginning of high stages in the stream might be

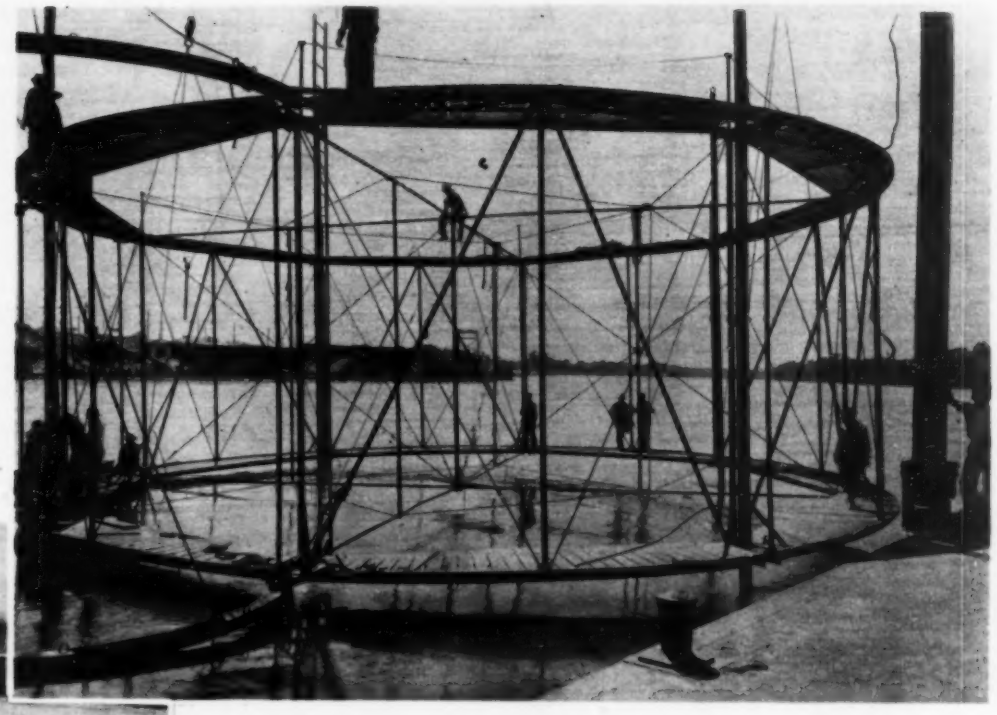
COFFERDAM UNWATERED, showing excavation for lock chamber completed and concreting under way from temporary plant.

BORROW PIT *(right)*, worked by elevating grader and 10-yd. pneumatic-tired, truck-hauled wagons, supplied material for rolled-fill embankment.



WEEP HOLES *(left)* in steel sheeting drain material placed hydraulically to fill cofferdam cells.

Construction Building of Landing Dam



TWO-STORY DEMOUNTABLE TEMPLET of structural steel guides driving of steel piles for circular cells of cofferdam.

expected in December of last year.

Records showed that on the average once in about four years a stage of 390 ft. might be expected. This being the average level of the flood plains, such water level would make the construction area inaccessible in any case. It was therefore decided to build the cofferdam to an elevation of 390 ft. This is several feet below the average four-year flood stage, when the channel is restricted by construction operations. All work in the cofferdam is planned for a minimum of damage to it and to the equipment employed in case the cofferdam is overtopped.

Proceeding on this basis, substantial progress was made on the two embankments when a cellular steel sheet-piling cofferdam inclosing the lock site was unwatered last October. Pouring of concrete was immediately started, with plans calling for the lock to be completed by January, 1937, except for the upstream miter sill and guard wall. Meanwhile, excavation will proceed on the preparation of the site for the power house and the adjoining end of the spillway structure.

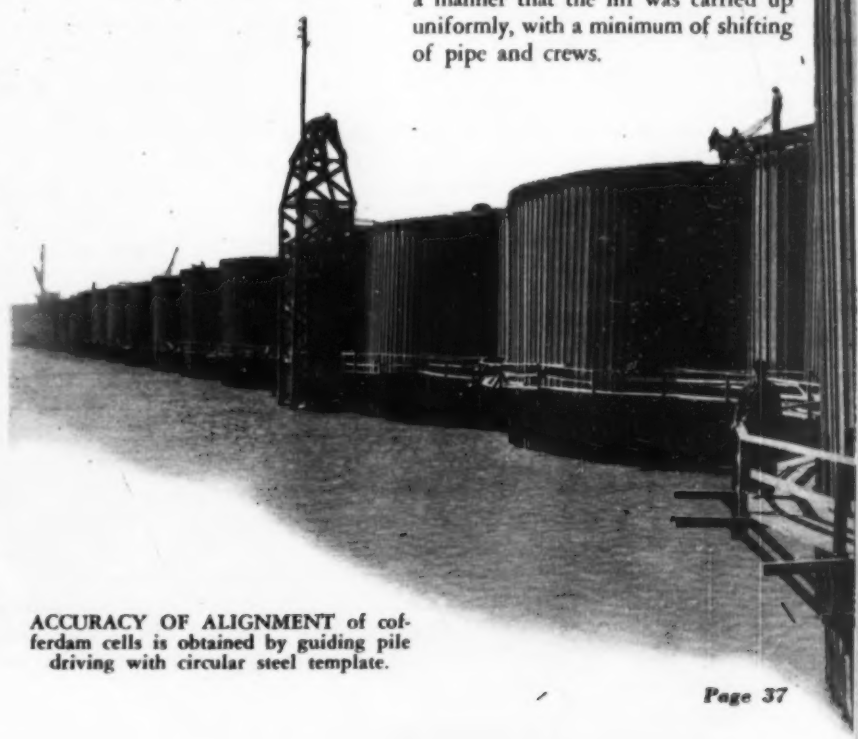
Hydraulic-Fill Embankment — On account of the comparatively restricted stream channel at the site of the dam, the lock was located in an excavation in the left bank, thus leaving the entire natural channel for the spillway capacity required. This excavation for the site of the lock required the removal of about 1,500,000 yd. of material, ranging from silt to coarse gravel, with considerable clay included, that was satisfactory for hydraulic-fill embankment construction. The 16-in. hydraulic dredge "Dallas" was accordingly acquired to make the required excavation and deliver the spoil into the 4,700-ft. embankment across the flood plain on the left side of the river.

Ledge limestone rock underlies the flood plain on that side of the channel at elevations ranging from 334 to 336 ft. The ground surface is comparatively flat, with a rise toward the higher ground. As described in the previous article, a line of steel sheetpiling was driven the entire length of the site of the embankment and on its axis. This sheetpiling was driven in a trench dug to a depth of about 20 ft., with sides on a 1:1 slope, bringing top widths to about 35 ft.

In placing the hydraulic fill the dredge discharge was handled in such manner that a core of impervious material was deposited in this trench and centered in the embankment. This impervious core was carried in the embankment to above the high water level of the reservoir that will be created by the dam. The steel sheeting along the center line of the embankment connects with a line parallel with the axis of the stream channel and just inside the concrete lock-chamber structure. With the impervious core of the embankment it forms the seal on that end of the dam.

Placing the 1,145,000 yd. of material required to complete the embankment that closes the flood plain on the left side of the valley proceeded substantially along the lines summarized in the previous article. Undesirable surface material was stripped from the site of the fill. Dikes were thrown up along both toes of the embankment with crawler power shovels equipped as draglines.

First, a section 1,250 ft. in length was started in this manner next to the site of the lock chamber. Two 16-in. discharge lines were laid from the dredge lengthwise of the first section, one about 30 ft. inside of each dike. After the dredging was well started the established practice was to deliver through one line at a time but to shift the discharge from side to side in such a manner that the fill was carried up uniformly, with a minimum of shifting of pipe and crews.



ACCURACY OF ALIGNMENT of cofferdam cells is obtained by guiding pile driving with circular steel template.

DEFLECTOR is attached to end of discharge pipe from dredge forming top lift of hydraulic fill.

Working in this manner the embankment was carried up in lifts of about 3 ft., the first section being completed practically to the finished height before the next section in-shore was begun. The entire embankment was thus divided into two sections that were built in succession from the channel to the high-ground end of the fill.

Stop planks built in 16-ft. lengths for convenience in handling were shifted by hand to guide the deposition of the material delivered by the discharge pipes. Under certain conditions the character of the material pumped made desirable the use of a floating boom of timbers, as shown in one of the pictures, in order to avoid too rapid surface movement of the water and to drop the fine material exactly where wanted. When the embankment had been carried to a height where the width was only 50 ft., the rest of the material was placed with a single discharge line from the dredge.

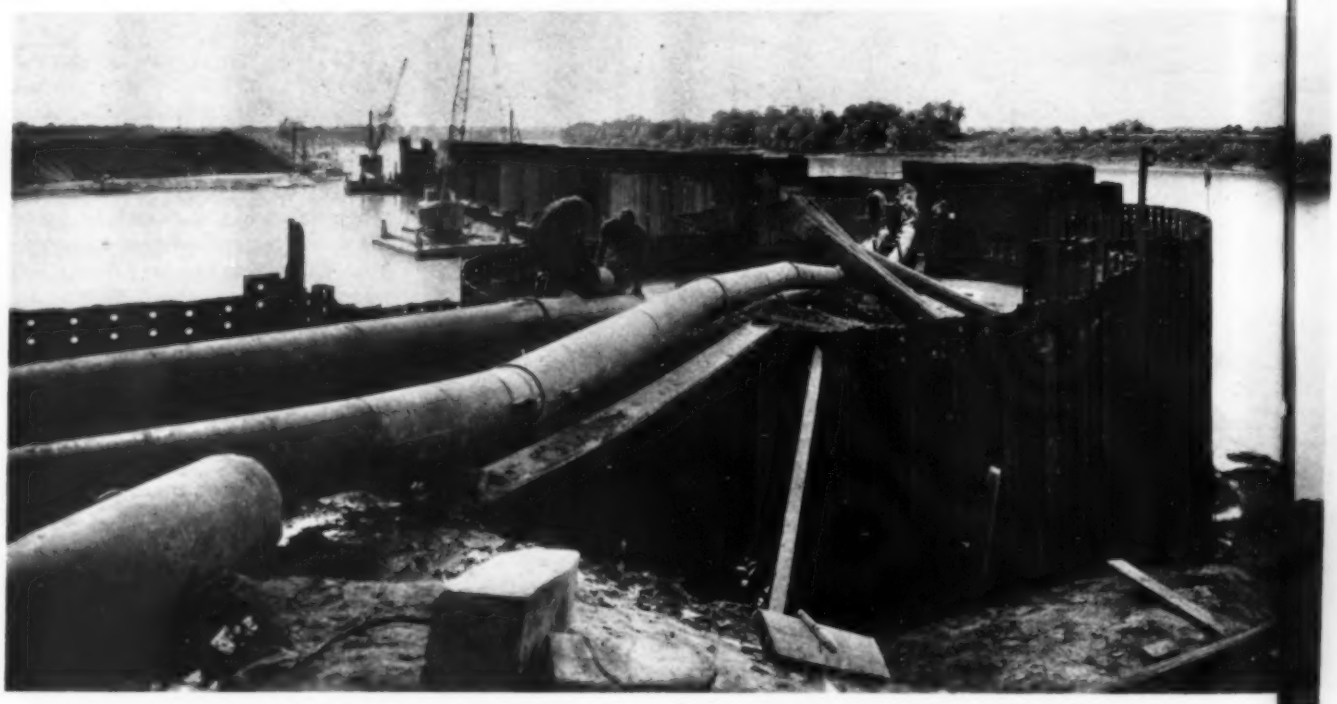
To avoid scouring of the dikes inclosing the discharge pool at the end of the pipe line, inclined guide boards were placed, as shown in another picture. A distributor baffle also was hung on the end of the pipe to eliminate scouring from the impact of the discharge. With this control it was possible to top the embankment out with the dredge and the discharge line practically to the finished slopes of the design.

Rolled-Fill Embankment — Because of the short haul and greater time available for the work, which permitted shutdowns during rainy weather the decision was made to build the embankment closing the flood plain on the right bank partly by the rolled-fill method. All of the 1,649,000 yd. required to make this embankment was obtained from the site of the powerhouse and tailrace area.

cupied by the lock structure rendered the cellular steel-piling type especially suitable. The underlying limestone in the bed of the stream is covered with only from 6 to 12 ft. of gravel. This same limestone formation continues uniformly entirely across the base of the valley. It was practically uncovered in the dredging operations on the excavation for the lock site which produced the material for the hydraulic-fill embankment.

By constructing a cofferdam wall of sheet-pile cells parallel with the stream channel and about on a line with the original channel bank face for a length of approximately 1,500 ft., it was possible to close the two ends by short connections into the bank. A 300 x 1,500-ft. area was thus inclosed and unwatered so that the foundation for the lock might be prepared and all form and concrete work conducted in the dry.

From an accompanying photograph



FILLING OF CELLS of sheet pile cofferdam is done by dredge pipe carrying material from lock excavation.

The material was excavated by a power-driven Adams elevating grader drawn by a Caterpillar tractor. The grader delivered to Euclid 10-yd. bottom-dump Trac-Truck trailers, which hauled to place in the fill. Under the most ideal local conditions, the elevating grader outfit would dig and load an average of 250 yd. per hour continuously. Between June 1 and Nov. 1 approximately 550,000 yd. were placed

Material was dumped in the fill with the tractor trailers in motion to avoid piles that would result in loose and hard spots. With a Caterpillar tractor carrying a bulldozer, each load was immediately levelled off to a layer averaging about 6 in. deep. The layers were then continually compacted by means of a sheepsfoot roller to obtain maximum consolidation.

Cellular Sheet-Pile Cofferdam—Conditions at the site of the cofferdam needed to unwater the space to be occupied by the lock structure rendered the cellular steel-piling type especially suitable. The underlying limestone in the bed of the stream is covered with only from 6 to 12 ft. of gravel. This same limestone formation continues uniformly entirely across the base of the valley. It was practically uncovered in the dredging operations on the excavation for the lock site which produced the material for the hydraulic-fill embankment.

By constructing a cofferdam wall of sheet-pile cells parallel with the stream channel and about on a line with the original channel bank face for a length of approximately 1,500 ft., it was possible to close the two ends by short connections into the bank. A 300 x 1,500-ft. area was thus inclosed and unwatered so that the foundation for the lock might be prepared and all form and concrete work conducted in the dry.

From an accompanying photograph the general plan of the cofferdam walls and connections between the cells may be seen. The intermediate short-radius sections between the larger cells were adopted in order to be able to complete the erection, filling and removal of any of the larger cell units independently of the others. By driving each cell independently of the other it was possible to use the same template over and over again on each of the large cells.

Instead of the usual practice of filling the cells with material from mechanical excavators, the hydraulic dredge was employed, pumping gravel from the river bed. This method of filling introduced some problems, all of which were readily solved, with the result that the filling was placed economically and rapidly.

Driving of the cofferdam was started at the upstream in-shore end and carried continuously downstream, with the closing at the lower in-shore end. The total height of the cofferdam cells in the off-shore reach is 55 ft. Piling of that length was accordingly used. In all, 4,100 tons of Bethlehem standard 15-in., 38.8-lb. steel piling was used, shipments being made from the rolling mill at Lackawanna, N. Y. by rail to Sheffield, Ala., and from Sheffield to Pickwick by barge. The sheetpiling used in the cut-off walls was shipped from Pittsburgh by water down the Ohio and up the Tennessee to the site.

All driving was done with two floating stiff-leg A-frame derrick outfits built and equipped by the Lambert division of McKiernan-Terry Corp. These two outfits worked together on opposite sides of the cofferdam as it progressed. Each was equipped with a McKiernan-Terry 9B3 steam hammer especially fitted for this kind of driving.

Special Template—Unusual accuracy

SECOND LIFT of hydraulic-fill embankment being made by discharge from two dredge pipes. Crews are shifting baffle-boards and floating booms for breaking up surface currents

of driving was obtained with the aid of a specially-designed demountable double-deck structural template, shown in an accompanying photograph.

The template was equipped with four 10-in. pipe piles which served as guides and supports for the frame. With these piles the template was readily set and accurately adjusted to position. The short-radius arcs of piling between the main cells were guided in driving by steel whalers attached to the last main cell wall and to the new one.

After all the piling of a cell was driven, it was filled to about the elevation of the river's surface by means of a clamshell bucket. After all the cells had been driven, dredge material was pumped directly into each cell, beginning at the upstream end of the cofferdam. The surplus water flowed out through six 10-in. holes which were burned in the river side of each cell about 4 ft. from the top of the cell. Later these holes were closed and the filling was continued to the top of the cell. When all of the main cells had been filled the smaller connecting cells were filled by hydraulic pumping and the job was complete.

In order to eliminate the accumulation of any hydraulic head in the cells rows of weep holes were punched at the mill in every third section of all piling to be used in walls on the bank side of the cofferdam. These holes were spaced 3 ft. apart, thus making rows of holes of that spacing in the wall of the cell. These holes were left open unless accidentally closed by clogging.

This method of draining avoided unbalanced pressures on the walls of the cells so effectively that no displacement occurred while the cofferdam was being built nor afterward. In fact, the alignment of the piling is exceptionally true and accurate.

Driving of the 4,100 tons of steel piling in the cofferdam, comprising in all 4,151 pieces, was started during the later part of August. Four 6-hr. shifts were employed six days a week, with very few interruptions from weather or plant difficulties. The last piling in the main coffer was down on Oct. 4. During the interval there were 28 working days, so that an average of 145 tons of piling were driven every 24 hr. while the job was under way.

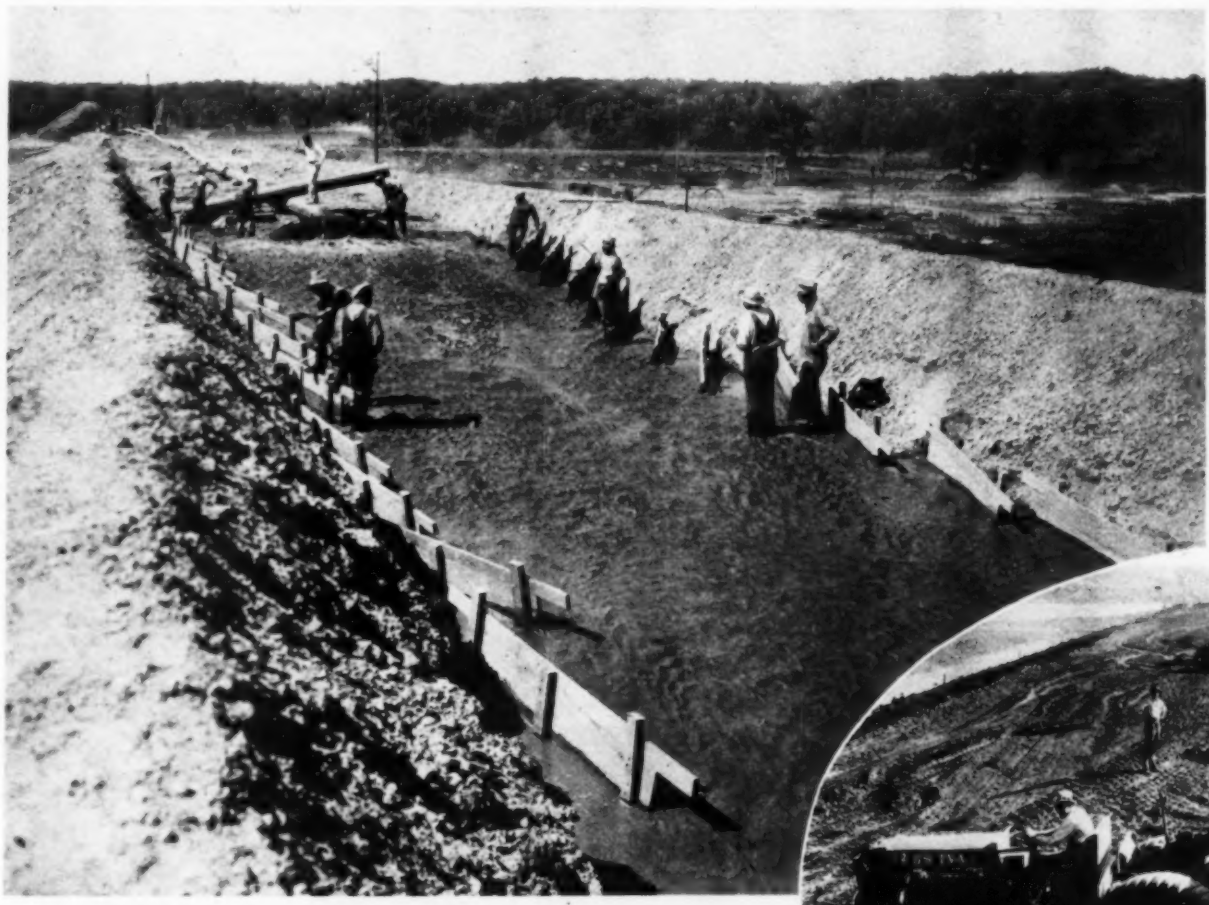
As soon as the cofferdam was closed it was immediately unwatered by seven 10- and 12-in. motor-driven centrifugals, some of which were then set up for permanent service on the job. No difficulty was encountered in unwatering, and since then practically the only inflow has been some seepage from the land side.

When the cofferdam was unwatered the shallow covering of gravel and silt over the ledge-rock foundation was easily removed with power shovels. The surface of the rock was found to be such that very little of it had to be stripped.

In the beginning of concrete placing in the lock a temporary mixing plant was erected inside the downstream corner of the cofferdam. Floating equipment supplied this temporary plant with sand and gravel dredged from the river in the vicinity. Delivery from the temporary mixing plant to the whirley cranes at the point where placing was under way was made in buckets on motor trucks operating on the bottom of the cofferdam.

Later, an aggregate handling and mixing plant which will be used to complete the entire job was erected on the bank adjacent to the lock. Placing will be done largely by units employed previously on the Wheeler dam project of the Authority, 68 mi. upstream. The arrangement of this permanent plant and the methods of handling concrete on the job will be described in a subsequent article.

Personnel — Arthur E. Morgan is chairman and chief engineer of the Tennessee Valley Authority, Carl A. Bock is assistant chief engineer, C. H. Locher, construction consultant, T. B. Parker, supervising construction engineer, Ross White, general construction superintendent and A. J. Ackerman, construction plant engineer. At Pickwick, A. L. Pauls is project engineer, R. F. Olds is construction engineer, and L. H. Huntley is construction superintendent.

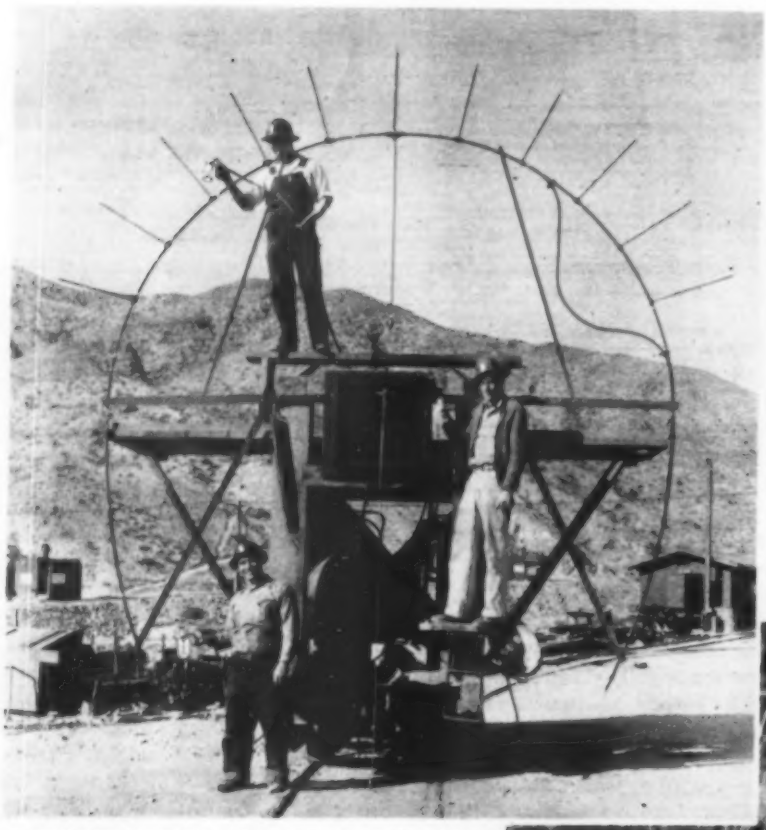


BAFFLE BOARDS on hydraulic fill prevent scour from dredge pipe discharge in topping out embankment.

BIG PNEUMATIC TIRES *(right)* enable hauling units to traverse soft material placed in 6-in. layers to form embankment. In background, sheepsfoot roller consolidates fill.

Getting Down to DETAILS

Close-Up Shots of Job Methods and Equipment

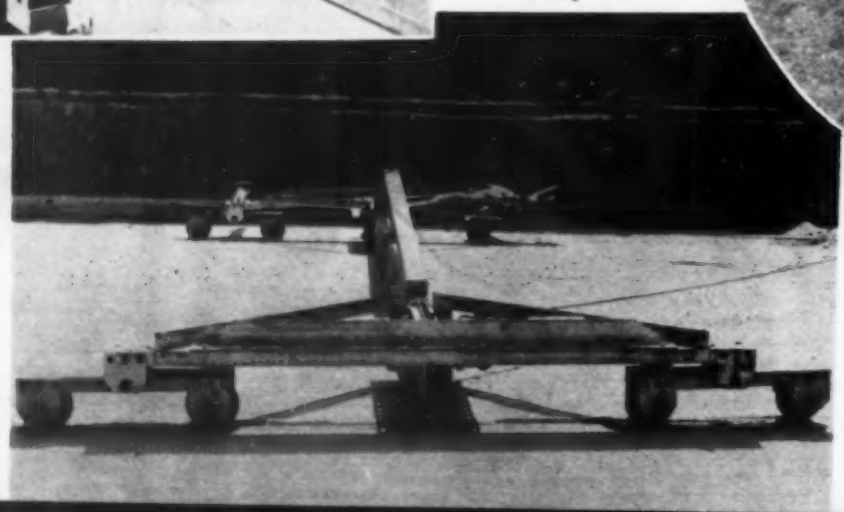


TUNNEL FEELERS of spring wire designed by Bill Sanders and Art Cutts of Metropolitan Water District's engineering staff and erected on frame to shape of desired tunnel section prove useful in trimming Long Canyon bore of Colorado River aqueduct in California. Built primarily to guide painting of "tight" rock, spring-wire templet after changing lengths of feelers serves also in scribing timber sets and checking steel supports inside of "A"-line. Templet is mounted on carriage equipped with 30-cu.ft. compressed-air receiver which supplies air through reducing valve to paint spray gun for marking points of protruding rock. Receiver is charged periodically by tapping 6-in. compressed-air line in tunnel.

ROTARY BROOM *(below)* driven by small pneumatic-tired industrial tractor performs important service in keeping highway clear of mud, dust and gravel, thus making pavement safe for contractor's trucks and vehicular traffic in all kinds of weather, on widening project being built by E. L. Gates, of Wolf Point, Mont., on Salmon River Cutoff, in Oregon. Power broom cleans roadway economically.

DETACHABLE RAILING of light structural aluminum can be removed on flood warnings from reinforced-concrete multiple-arch bridge across Rio Grande between Laredo, Tex., and Nuevo Laredo, Mexico, preventing recurrence of experience during 1932 flood when substantial fixed railing held jam of driftwood and two steel trusses from upstream railroad bridge. Light standards over piers likewise are removable.

TO DETERMINE LOCATION OF BURIED PIPE *(right)*, magnetic detector developed by G.E. engineers possesses sensitivity and accuracy sufficient to find iron or steel pipe lines having any magnetic bearing laid as long as 40 years ago under 7 ft. of earth and as much as 100 ft. from their supposed locations. Device may be used without electric current through pipe (except in case of non-magnetic pipes), although small current established between accessible hydrants and gates makes for easier and more certain search. Instrument cannot be used near trolley lines. Procedure for finding hidden pipe is simple.

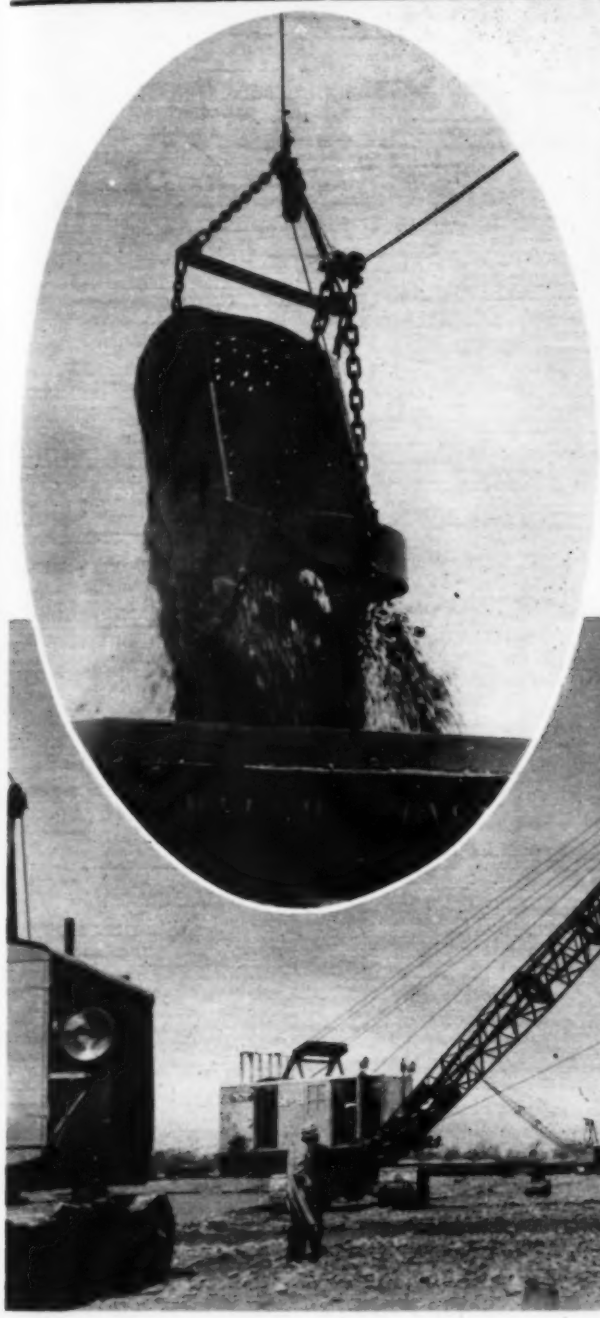


DISK WHEEL TEMPLET *(left)* for striking off cushion in brick pavement construction has top truss, metal cutting edge, and long supporting member between wheel trucks to compensate for irregularities in base.

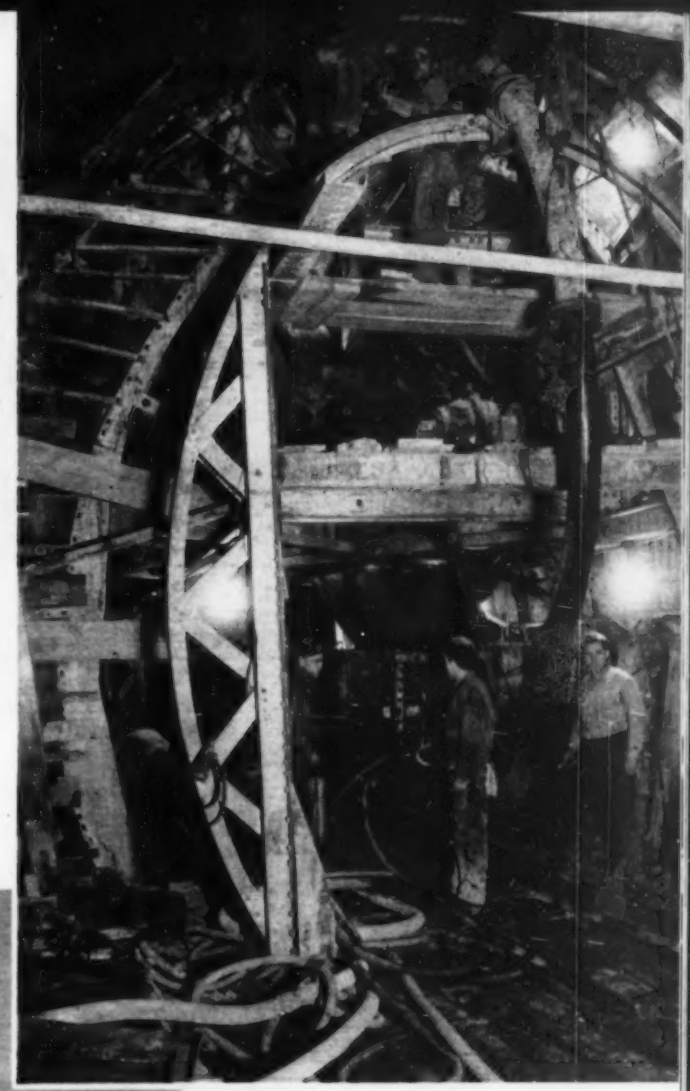
Wanted — PHOTOS OF DETAILS

The Editor of Construction Methods wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.



PERFORATED BUCKET *(above and in oval)* on 3½-yd. dragline at borrow pit of Walsh Construction Co. on Syracuse, N. Y., track elevation project for New York Central R.R. enables excavator to pick up greater volume of gravel from below water level and handle dewatered load more rapidly. Similar perforated buckets assist two 2¼-yd. draglines loading trains at same site.



PNEUMATIC CONCRETE PLACER delivers concrete through pipe and hose to crown of steel forms in Chicago's Southwest intercepting sewer, Contract 3, being executed by S. A. Healy Co. for Sanitary District of Chicago, W. H. Trinkhaus, acting chief engineer, as part of $56,000,000 PWA construction program. Temporary steel tunnel lining is left in place. Concrete is thoroughly vibrated and grouted to fill all voids.

"LEAPING LENA" is name applied by workers on San Gabriel dam No. 1, in California, to this gasoline-powered Delmag explosion rammer *(right)*, of German design, for compacting earth fill along abutments and at other places not easily accessible to regular sheepsfoot rollers used to consolidate embankment material. Machine, weighing ½ ton, jumps 9 in. from ground at each explosion and falls back to tamp earth beneath it. Device makes about 50 jumps per minute and automatically moves forward about 6 to 8 in. at each jump. It is guided by one operator, who controls machine through hinged horizontal handles, as illustrated. San Gabriel dam No. 1 is being built for Los Angeles County Flood Control District, of which C. H. Howell is chief engineer, by West Slope Construction Co.— Photo from Paul Baumann, junior assistant chief engineer, Los Angeles, Calif.

SIXTH OF A SERIES OF ARTICLES

Planning and Plant for
HEAVY CONSTRUCTION

Principles and Practices of Job Layout and Selection and Use of Equipment for Large Dams and Appurtenant Works

By ADOLPH J. ACKERMAN *and* CHARLES H. LOCHER
Construction Plant Engineer *Construction Consultant*
TENNESSEE-VALLEY AUTHORITY, KNOXVILLE, TENN.

...6...

Small Tools

Measuring Equipment Performance

Analyzing Reports

SMALL TOOLS — Along with the basic setup of plant and equipment to take care of the fundamental routine operations, there are thousands of special operations which must be adequately provided for. The development of small tools for large jobs has in many respects been remarkable and not fully appreciated by the foremen, who should be most familiar with them. Numerous types of air-driven equipment such as hoists, sump pumps, wrenches, acetylene torches, chain hoists, portable electric saws, portable electric welders, small utility cranes, and a variety of smaller tools are indispensable on a large construction job. A great deal of money is lost by permitting heavy-duty equipment to do jobs which some of these smaller units can do as well, and frequently the smaller tools are in a position to earn more per dollar invested than can be gained from the heavy-duty equipment if permitted to be used promiscuously on various odd jobs.

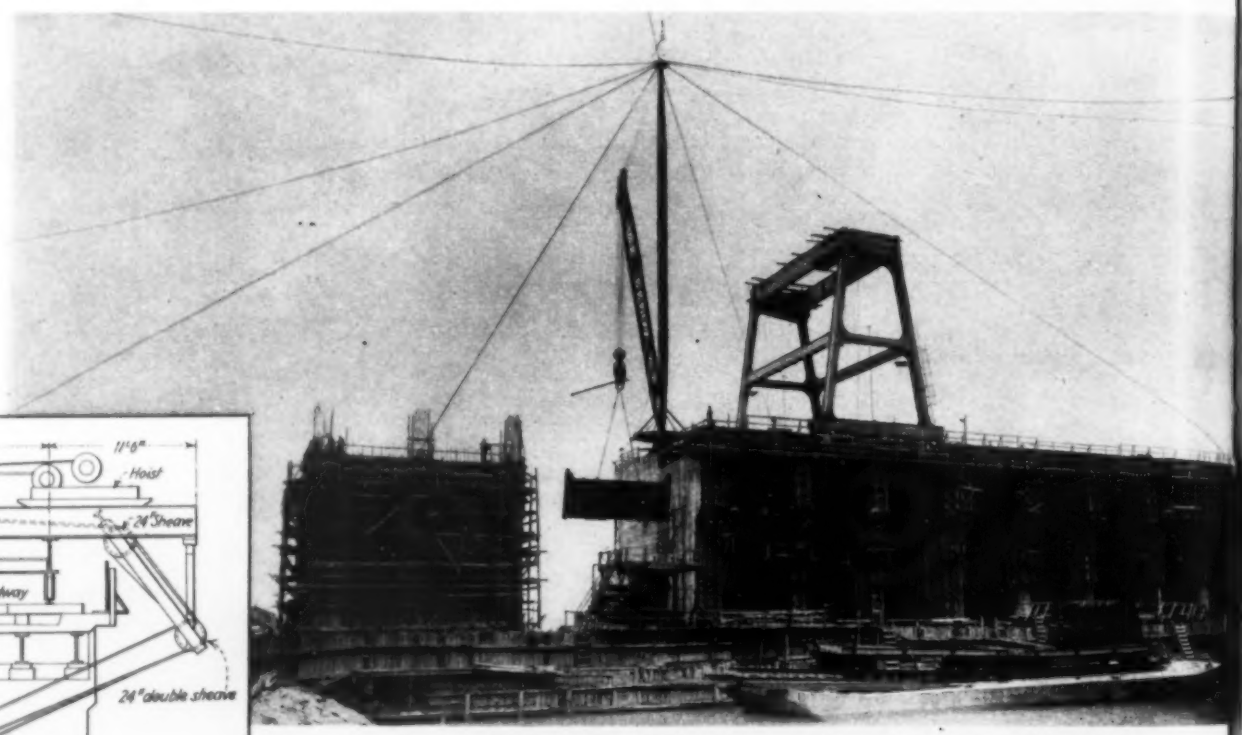


Fig. 1 . . . SPECIAL DERRICK set-up for erecting gantry crane and handling heavy castings at Wheeler dam.

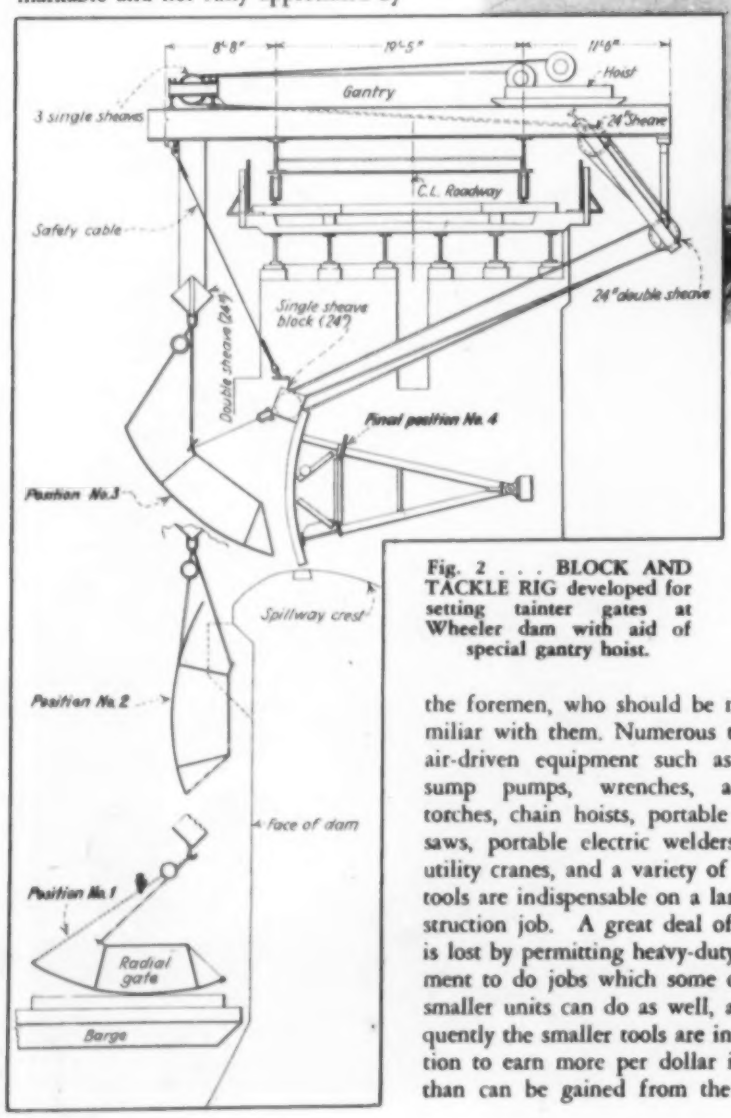


Fig. 2 . . . BLOCK AND TACKLE RIG developed for setting tainter gates at Wheeler dam with aid of special gantry hoist.

Special Erection Problems — Another special set of problems on every large job is related to the erection of heavy equipment such as spillway gates, lock gates, turbines and generators, cranes, gantries and bridge girders. First of all, it is important that the superintendent make adequate advance plans for proper shop assemblies into such size and weights as can be readily handled on the job, and along with this, the arrival on the job must be carefully scheduled. For erection, special setups of derricks, cableways, gin poles, or other erecting and hoisting machinery are required. Such a setup, illustrated in Fig. 1, shows a carefully spotted guy derrick which is being used to assemble a large gantry crane and at the moment is delivering some heavy castings from the barge in the foreground to the power house area on the other side of the intake structure. Incidentally, this gantry crane is being erected almost a year before the power house is to be placed in actual service. In the meantime, the crane will be used in assembling the intake gates, setting them in their designated places and manipulating them during the remaining construction period for passing the river temporarily through this structure while the final portion of the main dam is being completed.

Proper planning for special equipment to handle such items as flood gates, is shown graphically in Fig. 2 which illustrates the proposed methods of handling 60 tainter gates, 40x15 ft., on the Wheeler dam. This study, first of all, confirmed the desirability of having the front of the gate completely shop-assembled and shipped on barges to the dam site, thereby greatly reducing the amount of work to be done on the job. The diagram shows a

CRANE CAR pulls forms and supplements service of heavy-duty cableway on dam construction.

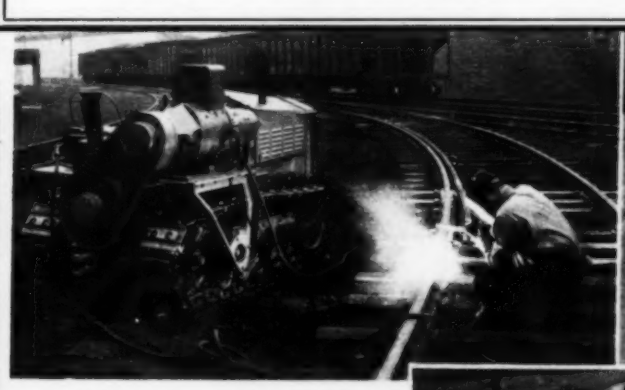
IMPACT WRENCH, air operated and reversible, turns up nuts on bolts for steel scroll case.

Photo, Skilsaw

ELECTRIC SAW finds many uses on building and other types of construction.

SMALL TOOLS AND LIGHT EQUIPMENT ON HEAVY CONSTRUCTION

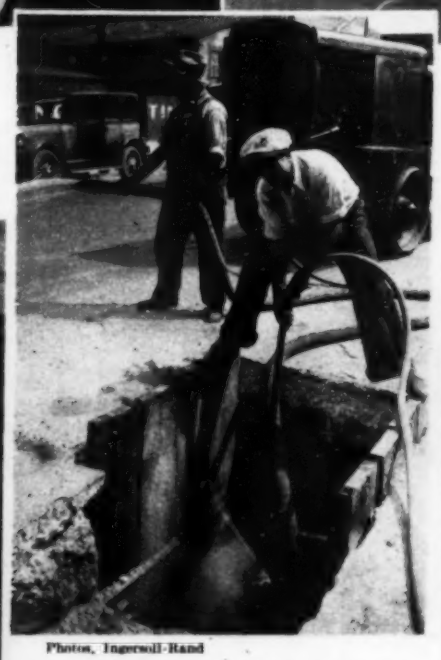
CHAIN HOIST (Yale & Towne) simplifies setting of stone facing on large Government building.



ELECTRIC WELDER is made mobile utility rig by mounting on Cletrac tractor.

OXYACETYLENE TORCH is effective for cutting heavy structural steel members.

UTILITY HOIST *(right)* operated by compressed air, eliminates use of heavy crane or derrick in erecting steel for circular tank.



Photos, Ingersoll-Rand

SUMP PUMP receiving air from portable compressor unwaters sheeted trench.

PULLER JACK enables heavy steel centering for bridge to be moved by hand power.

small job-built gantry which runs on the roadway on the top of the dam; by properly arranging the block and tackle the gate frame can be lifted from the barge, turned into a vertical plane, hoisted and pulled back into final position under the roadway.

Measuring Equipment Performance — Everyone experienced in modern manufacturing methods takes it for granted, upon entering a large machine shop, that he will find careful records being maintained on each individual machine with respect to identification, number of hours working, regular attention to maintenance and oiling, detailed records of any repairs, including nature of repairs and their costs, speeds of operation, productivity of the machines, etc. All of these records are carefully analyzed to discover ways and means for improving the reliability and increasing productivity of machines.

These are exactly the same operations and observations which should be maintained on every construction job. It is surprising to find on many jobs that superintendents take as a matter of course the keeping of a detailed record of $4 or $5 daily expenditures on a man's time, yet have practically no operating records whatever on a machine whose time is worth $50 or $100 per day. Too frequently the attitude is taken that as long as the shovel is bailing out dirt everything is O.K., whereas a careful study of operating performance may disclose that the shovel has a daily use-efficiency of only 60 to 70 per cent. There is no substitute for accurately maintained records of performance, and they will pay for themselves many times over if they are carefully studied and judiciously used.

Property Card — First of all, there should be a convenient record card showing in detail the general description of the machine. An example of such a card is shown in Fig. 3. Not only is such a record of value to account for the property, but it is very handy reference for the construction planner in studying further uses of the equipment.

TVA 337

Tennessee Valley Authority **PROPERTY RECORD — DETAIL** Project Pickwick Dam

EQUIPMENT Tractor — "50" TVA No. 21222

See Bulldozer TVA 21295

MFGD. BY — PROCURED FROM

REQ. P.O. K-35-1627 C.R. OR R.R. DATE RCD. 3/4/35

SERIAL NO. 5A-979W TYPE 50 JOB NO. 4 SHIPPING WT. 20,000 lbs.

LOCATION

DESCRIPTION AND ACCESSORIES AS OF: April 25, 1935

Engine:
- 4-cylinder
- 4-cycle
- Water-cooled
- Bore and stroke, inches 5½x6½
- R.P.M. — governed at full load ... 850
- Piston Speed in F.P.M. 921
- R.P.M. at max. drawbar pull 600
- Displacement cu. in. 618
- N.A.C.C. horse power rating (for tax purposes) 48.4
- Lubrication ..... Force feed
- Capacity (crankcase) ..... 14 qts.
- Cooling system capacity ..... 11½ gal.
- Crankshaft: Number bearings 3
- Diameter main bearing in in. 3¼
- Magneto: "Eisemann" Model CT-4; No. H-5996
- Carburetor: "Ensign" Model — KE-67

General Data:

Gage (Center to center tracks) in.	60
Length of tracks on ground (Center drive sprocket to idler) in.	81⅞
Area ground contact (with stand. shoes) sq. in.	2,948
Overall: Width in inches	81⅞
Length, inches	146¼
Height, inches	75½
Ground clearance, inches	11¼
Height drawbar from ground	15½
Lateral movement drawbar in.	25½
Fuel tank — capacity in gal.	60
Track; "Standard"	
Width; inches	18
Height grouser — in.	2-3/16
Track Shoe bolts, diam. in.	⅝
Track pin, diam. in.	1⅜
Track pin bushing, diam. in.	2⅜
Steering: Plates in each steering clutch	
Number	20
Friction area sq. in. (each)	61
Total friction surface sq. in.	1,220

Fig. 3 . . . PROPERTY RECORD CARD carrying detailed description of machine.

Fig. 5 . . . RECORDING AMMETERS installed in a hammermill at sand plant. Chart from this meter is shown in Fig. 6.

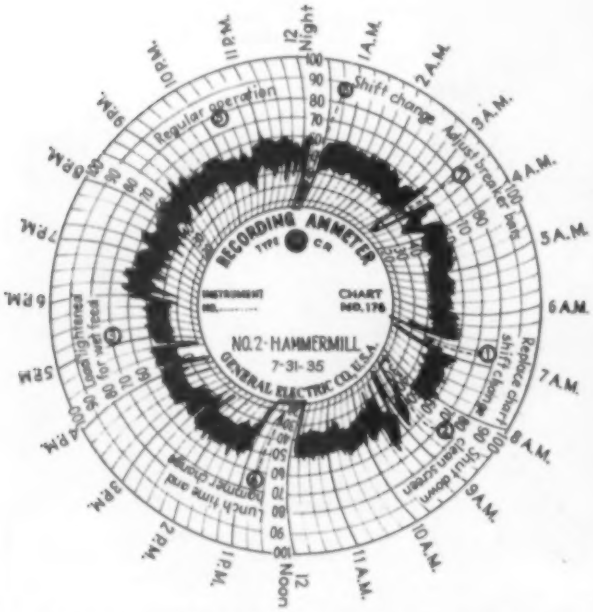


Fig. 6 . . . SAMPLE CHART obtained from recording ammeter on hammermill in sand plant.

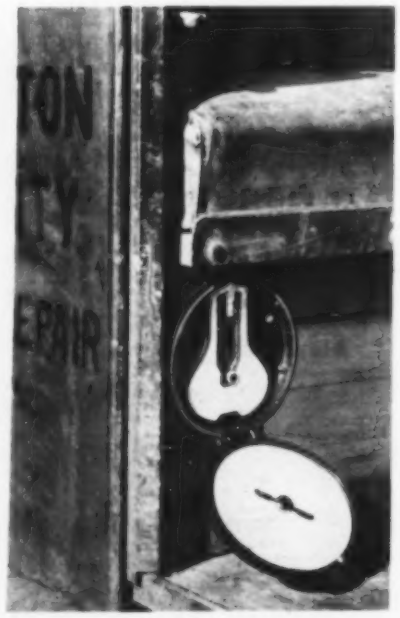


Fig. 7 . . . SERVICE RECORDER installed on motor truck body. Instrument is open to show location of chart on inside of cover. Specimen chart in Fig. 8.

Records Which Help to Keep Equipment Working — A successful construction superintendent was discussing some of his early experiences about as follows:

"When I was learning this business as an excavation foreman on some of the jobs down South we had an old superintendent who never felt happy unless he had 8 or 10 derricks set up and a bunch of extra equipment on the side line just so he would be able to do what he wanted to do when he wanted to do it. It never looked right to me. It so happened that we were working near a small town and every day an Italian came by the job with a horse-drawn peanut roaster. I used to kid old Tony, and one day I said to him, 'Tony, don't you ever get tired of running this old hack around the town and listening to that squeaking whistle?' Tony answered right back and said, 'Ah, no, boss! No toota da whistle, no make-a da mon.'

"You know I have often thought about that. There was Tony with his money invested in an old plug and a peanut roaster and as long as he was keeping his outfit working it was paying him dividends. This construction business is about the same when you consider all of your equipment an investment which will earn money for you as long as you keep it going. I have always worked on the principle that it is better to wear out the equipment rather than to let it rust out."

This principle is certainly important and a great deal of effort is justified in developing a system of control which gives the superintendent full information of what is happening on his job in the way of keeping the equipment working as nearly to its full capacity as possible. One of the simplest forms is shown in Fig. 4, which shows an Equipment Use Report. This report is placed on the superintendent's desk every morning, and he sees at once what equipment is working, what

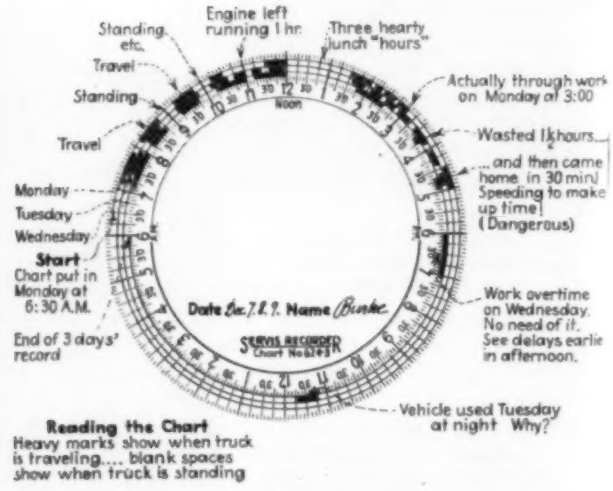


Fig. 8 . . . CHART FROM SERVICE RECORDER illustrated in Fig. 7. Heavy marks show when truck is traveling; blank spaces show when truck is standing.

is under repair and what is idle. Furthermore, if he knows what his equipment is doing, he knows what his job is doing.

However, it is not enough to know that the equipment is busy. Of even greater importance is to know *how* busy it is. This cannot be established effectively by the simple expedient of having the foreman keep an eye on it. In the first place, such a procedure is too expensive and, in the second place, it does not tell the story. Real control over equipment performance is obtained by recording its operations continuously, as for example, on graphical meters. A careful study of the recorded charts will reveal many unsuspected elements and opportunities for lower unit costs. The investment in metering equipment is generally a fraction of the saving which can be developed, not only in lowering the costs on the machine which is directly under observation but also, where the machine is a controlling link, in improving production all along the system. Leaks of dollars on bad equipment are quickly detected, and frequently redesigns can be made right on the job to stop such leaks.

Graphical Meters — Fig. 5 shows a graphical meter installed on the feeder circuit of a large motor on a hammer-mill in a sand plant. A representative chart from this recorder is shown in Fig. 6, and some of the indicated items are described directly thereon. This chart was taken from the mill at a time when most of the operating kinks had already been fully developed. Nevertheless, it showed that one shift change incurred a 15-min. loss of time. These charts were used to show what type of hammer and kind of metal would be most lasting with the rock quarried on this job and many thousands of dollars were saved as a result of these observations. Furthermore, the charts provide a direct indication to the operator for controlling the load of incoming stone at maximum efficiency without overloading the mill. The net operating time of the machine is disclosed and any unnecessary delays or interruptions caused at other points are clearly indicated and may be promptly corrected. With the charts once calibrated, they give a daily record of tons of sand produced.

Fig. 7 shows another type of recorder which is very simple and can be readily installed on any device which vibrates sufficiently when in operation to actuate a small stylus attached to a sensitive pendulum. Fig. 8 shows a typical chart and the large amount of information which is obtainable from such a chart. This includes a record of frequency of use, time of operation, average speed, frequency and extent of delays, and similar items. It is obvious that when such charts are discussed with the operator in charge of the equipment a very effective basis is provided for improving results.

SUPERINTENDENT'S EQUIPMENT USE REPORT WEEK END

Working ▭ Standby ▨ Under Repair ⊠

DAY / SHIFT / EQUIP	MONDAY 1st	2nd	3rd	4th	TUESDAY 1st	2nd	3rd	4th	WEDNESDAY 1st	2nd	3rd	4th	THURSDAY 1st	2nd	3rd	4th	FRIDAY 1st	2nd	3rd	4th	SATURDAY 1st	2nd	3rd	4th	SUNDAY 1st	2nd	3rd	4th
Truck 1	▨	▨	▨	▨	▨	▨	⊠	▨	⊠	⊠	⊠	▨	▨	⊠	⊠	▨	▨	▨	▨	▨	▨	▨	⊠	▨	▨	▨	▨	▨
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Tractor 1	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨	▨		▨	▨
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Fig. 4 . . . EQUIPMENT USE REPORT tells superintendent what machines are working, idle or under repair.

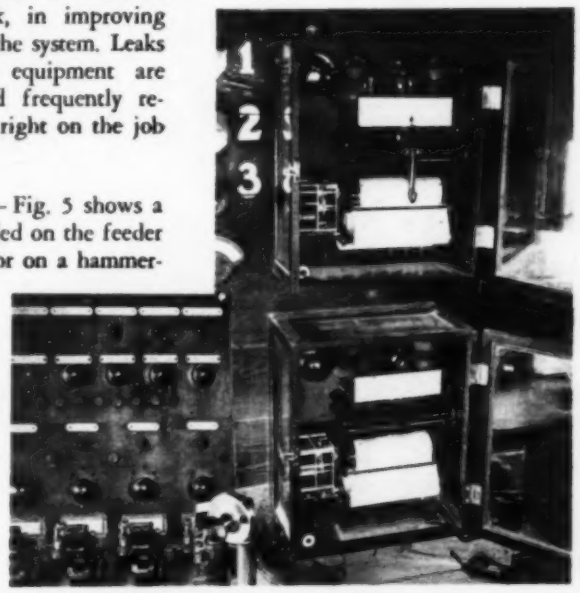


Fig. 9 . . . RECORDING WATTMETER *(right)* connected to motors of concrete mixer plant.

Another type of recording meter is shown in Fig. 9. These meters are wattmeters connected to the motors of concrete mixers in a mixing plant. The meters are located at the inspector's desk, and he knows at all times what is going through the mixers merely from observing the charts, a sample of which is shown in Fig. 10. He can see how long the batch has been in the mixer, when the mixes change from mass concrete to thin concrete or grout, or when the consistency of the mix changes due to excessive moisture in the sand. With such indications he can promptly make the necessary corrections for maintaining the desired water-cement ratio in the concrete. At the same time this record provides a convenient check on the number of batches per day. Knowing the cement requirements for the different types of batches, the operator can check back on the total cement consumption.

A further example of a recording from a graphical meter is shown in Fig. 11. In the operation of a large cableway the question arose as to how different operators handled the cableway controls and what their effect was on the circuit breaker and other electrical equipment. By connecting a recording wattmeter to the main hoist motors these charts were obtained. Much to the surprise of every one they indicated a tremendous amount of fluctuating power passing through the electrical system. The severe service placed upon the electrical contactors was clearly indicated by the varied methods employed by different operators in handling the controls. The operating cycle was in every case almost identical. With such a record it is considerably easier to instruct the operator in changing his technique, as he is generally quite proud of his ability and feels that the way he is doing the job is the only correct way. These charts also provide a check on the operator's reports of idle time, delay and working conditions, together with a count of the number of loads handled.

Checking the Entire Job — As previously stated, the proper application of recording graphical meters will occasionally disclose surprising information, as occurred recently on a large job where the superintendent decided to get a more accurate record of how efficiently the work was carried through at changes in shifts. He connected the wattmeters to the main substation circuit and the results he obtained are plotted in Fig. 12. The record from the power feeder running to the air compressors was a startling bit of news because it showed that at shift changes at 6 and 12 o'clock sometimes as much as ½ hr. was lost from the time drills and other air consuming equipment were shut down until they were started up again by the next crew. Naturally this disclosed to him immediately where he had to "put on the heat," and it wasn't long before he got much better recordings and practically no losses in time as the crews went off and on.

Analyzing Daily Operators' Reports — In addition to graphical records there are, of course, the operators' daily performance reports which, when properly analyzed and recorded, provide a considerable amount of valuable information. Fig. 13 shows a chart made up from daily reports on elevating grader and trucks; this at once gives the superintendent a clear picture of day-to-day performance. Of particular inter-

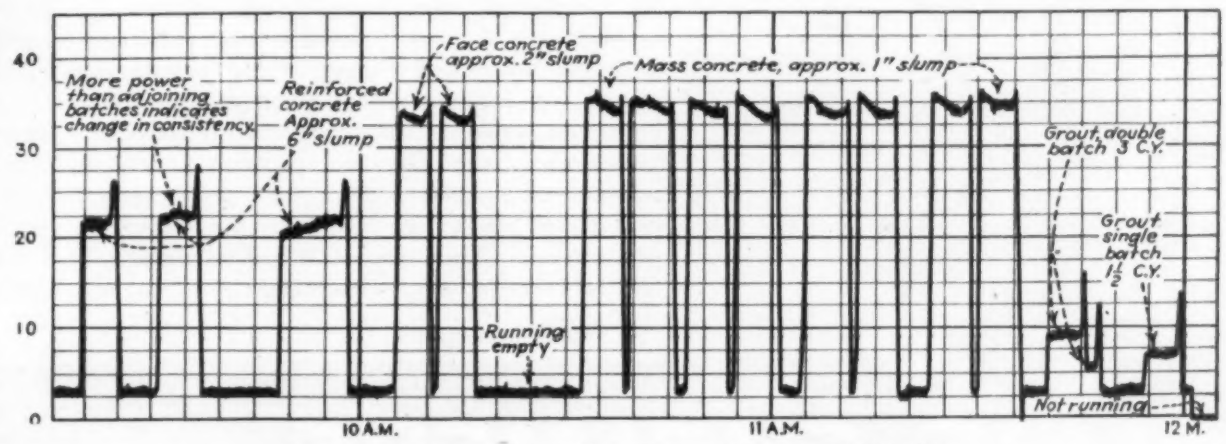


Fig. 10 . . . CHART from recording wattmeter in concrete mixing plant.

CONTROL MAKES THE DIFFERENCE

ONLY ALLIS-CHALMERS GIVES

CONTROLLED IGNITION

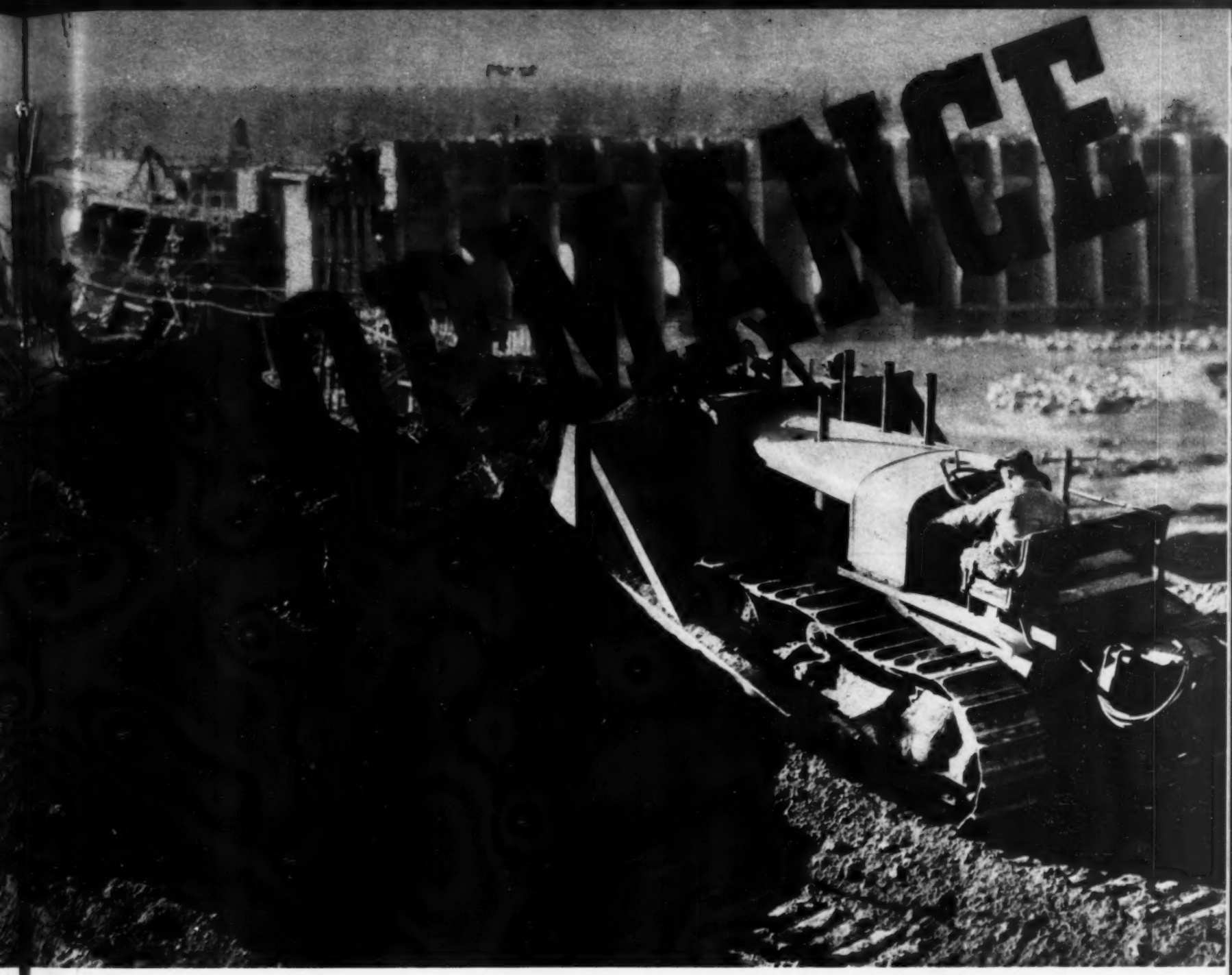
In the Controlled Ignition Oil Tractor, Diesel fuel oil is injected into the combustion chamber at 60° before top dead center—which provides ample time for thorough mixing with the air. At exactly the proper point, this mixture is ignited with a spark. Because the *ignition point is controlled*—there is no danger or chance of power-wasting pre-ignition. This improved system is *not* dependent on split-hair adjustments; the vibration problem is eliminated; heavy, unbalanced parts are unnecessary; power and weight are *balanced* for maximum performance. Only the *Controlled Ignition* Oil Tractor has these advantages.

CONTROLLED *Instant* STARTING

Regardless of weather, the Controlled Ignition Oil Engine starts easily and instantly. There is no need for complicated, expensive starting devices. Two or three upward pulls of the crank—or a push on the starter—and away she goes. Time saved in starting is time for useful work. Only Allis-Chalmers gives you this advantage.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

Controlled Ignition OIL TRACTORS



S YOU THESE IMPORTANT ADVANTAGES

CONTROLLED INJECTION OF FUEL

CONTROLLED FUEL INJECTION

An accurate charge of fuel is sprayed (not squirted) into the combustion chamber — regardless of load or throttle setting. Simplest fuel pump built — serviced without special tools; separate, individual unit for each cylinder. New type injector permits accurate measuring at idle speed. Nozzle valve protected from heat of combustion chamber.

PROPER MIXING BEFORE IGNITION

CONTROLLED AIR-FUEL RATIO

Just the right amount of air for efficient combustion of fuel at *all* loads and *all* speeds. Correct air-fuel ratio *eliminates* an excess of air at idle speed — which would lower exhaust temperatures *at the expense of power.*

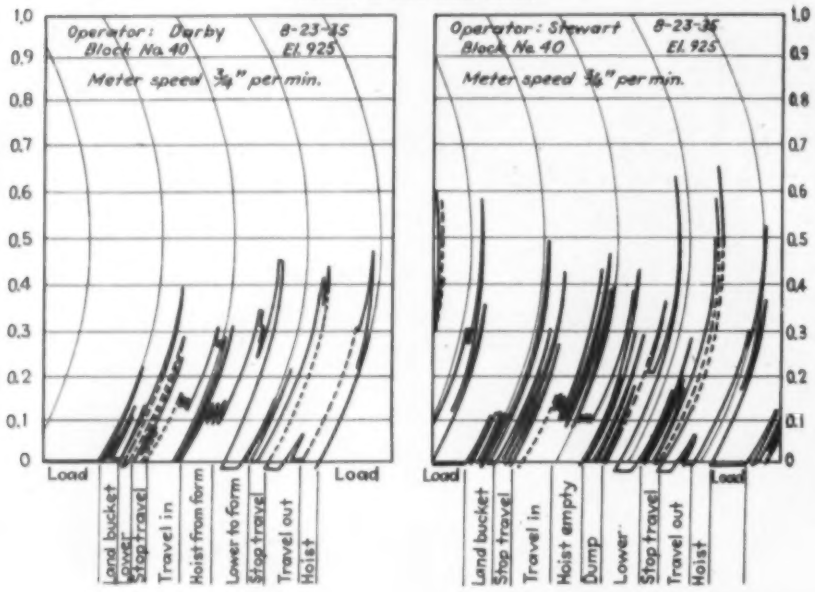
SPARK IGNITION— COMPLETE, INSTANT COMBUSTION

Now you can have fuel economy without the handicaps of high compression ignition. Now you can burn low cost Diesel fuel oil and—*in the same tractor*—you can enjoy the advantages of simple, instant starting... easy, inexpensive servicing... unexcelled lugging ability ... freedom from vibration "whip"... without heavy, expensive parts and hair-line adjustments. All this at low first cost and unequalled economy of operation. Only the A-C CONTROLLED IGNITION OIL TRACTOR gives you this combination of vital advantages.

WHAT PERCENTAGE OF YOUR DOLLAR GOES FOR LAY-UP LOSSES?

The larger and more expensive your tractor — the greater your loss per hour when the tractor is down for repairs. Allis-Chalmers tractors reduce lay-up losses in two ways: (1) Lower investment per tractor (2) Controlled Ignition assures dependable performance.

Fig. 11 . . . GRAPHIC RECORD CHARTS obtained from main hoist motors on cableway, showing complete cycle of handling concrete bucket to and from form.



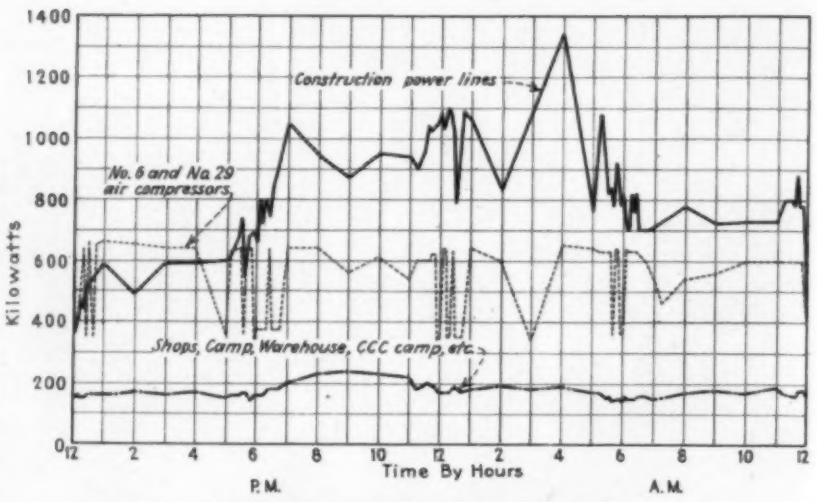


Fig. 12 . . . POWER CONSUMPTION for 24 hr. on large construction project. Curves plotted from recording ammeter chart.

est is the time required to get the operators broken in and build up the system to full capacity, which took about 20 days.

The chart shown in Fig. 13 was made up for the superintendent's own information. A similar record from the same operating reports was made up for the benefit of the foreman and operators on the job; this is shown in Fig. 14, which is especially designed so it is readily understood by the operators. The chart was mounted on a board 24x36 in. and posted at the site of the work where the operators greased their equipment and changed shifts. Improvements in performance are clearly indicated, for example, by comparing the loads handled during July with those handled in succeeding months. It was surprising how these charts stimulated competition and rivalry between shifts, together with the usual number of alibis, many of them quite real, of course, from the crew that made the least number of loads. Naturally many of these complaints contain valuable suggestions to the superintendent which he can use for improving operations. The net result is a keen appreciation among the operators that the management is giving full recognition to what they are producing.

Fig. 15 is an interesting chart because it indicates the possibilities of showing graphically a large amount of data which, in this case, was prepared from about 20 pages of typewritten material. The chart shows the result of tests made on wagon drills in a quarry to determine the effectiveness of three different makes. All of the production information in number of lineal feet drilled and different depths of holes is shown in direct relationship to actual performance and the various kinds of losses in time which were incurred during these tests. The influence of various types of losses

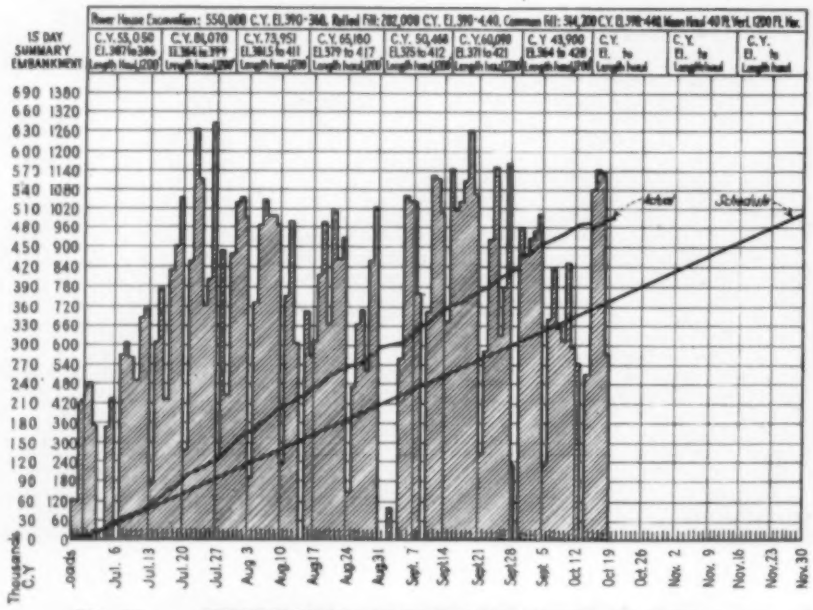


Fig. 13 . . . PERFORMANCE AND PROGRESS made by elevating grader and tractor trucks, giving superintendent clear picture of day-to-day performance.

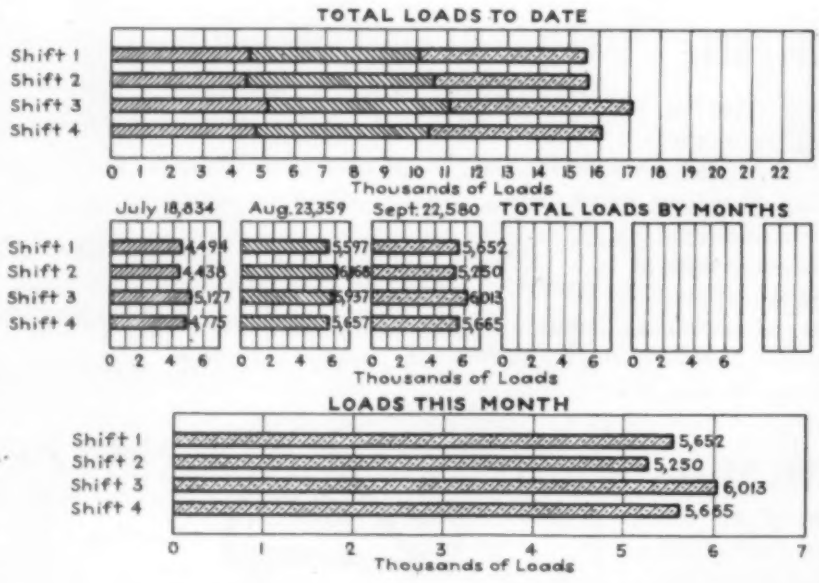


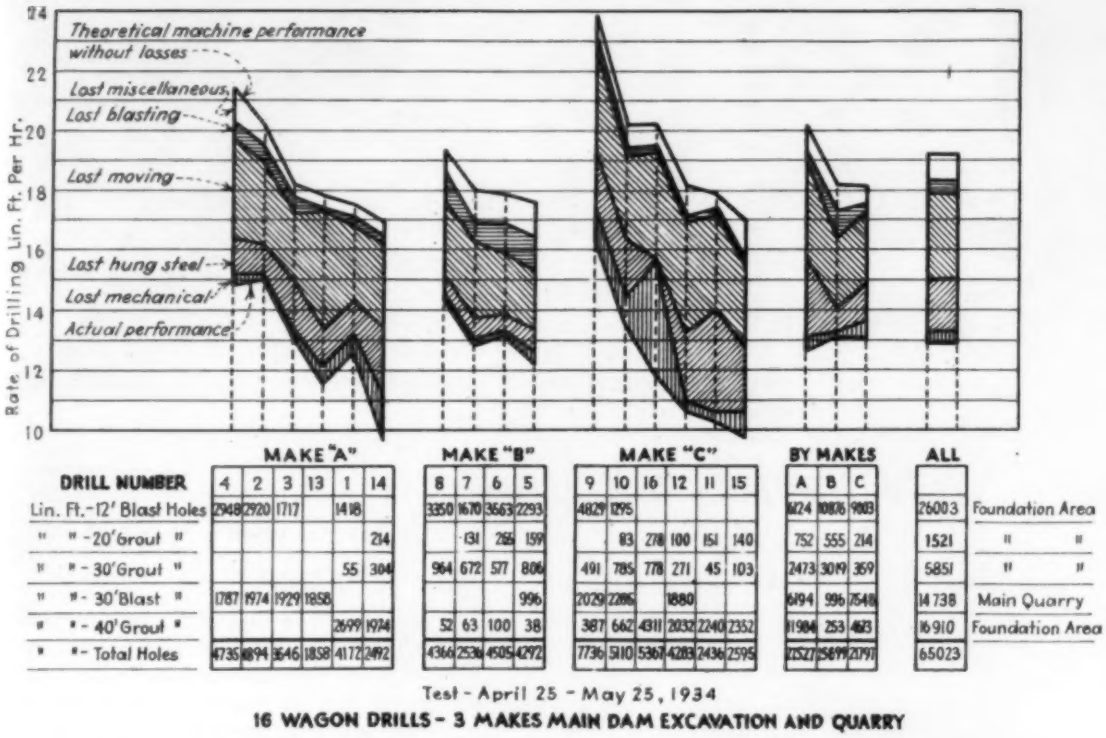
Fig. 14 . . . COMBINATION PROGRESS CHART and cost report made up for superintendent's information. Chart is designed for ready interpretation by operators, to show comparative performance between shifts.

upon total drill performance and comparison between different makes and average results are all clearly shown pictorially on this one chart.

Fig. 16 is another type of chart which is of considerable importance to superintendents and foremen assigned to operations which are recurrent and routine, as in this case, where three 5-cu.yd. trucks were transporting sand a distance of 4 mi. and operating on four 5½-hr. shifts, or a total of 22 hr. per day. This operation was going along to the apparent satisfaction of every one concerned until it was decided to make a time study and actually see what was going on. The gross operating time was first plotted on the chart. This represents the time for which the drivers actually received pay. Along with this the net operating time also was plotted, which showed the reported truck time when the truck was actually hauling the sand.

The average gross operating time was 76 min.; the average clocked time necessary to make the round trip, with no delays, was 40 min., so that there was an apparent delay time of 36 min., almost half of the gross time. As a result of this study, a table was prepared which is shown in the chart as "daily hauling rates" which gives a schedule for the same operation based on 47 min. for an average round trip. Depending upon the demands for sand for a given day, the foreman immediately knows how many trucks he must send out and how many shifts he must operate them. While it may at times be difficult to follow exactly such a schedule, it can at least be approximated and result in the elimination of costly delays.

Major Replacement Record — Fig. 17 shows another type of chart which is very helpful where large supplies of replacement parts must be kept on hand at all times. In this case records have been prepared on a dredge operating in an abrasive material with the resulting high wear of hub-shells, propellers and many other parts. This chart gives a full history of performance indicating the life in each part as well as number of parts on order and in stock and parts repaired and returned to service. Generally such parts are rather complicated castings which may require from one to two months between the date of order and

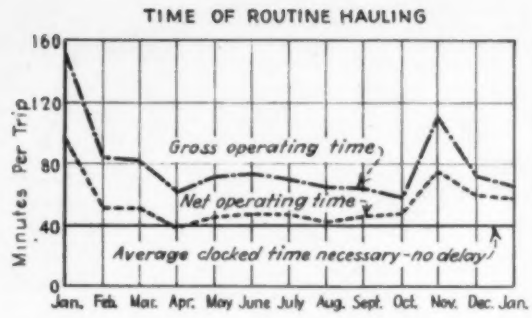


DRILL NUMBER	MAKE "A" 4	2	3	13	1	14	MAKE "B" 8	7	6	5	MAKE "C" 9	10	16	12	11	15	BY MAKES A	B	C	ALL	
Lin. Ft.-12' Blast Holes	2948	2920	1717		1418		3350	1670	3563	2293	4829	1295					6424	10876	9803	26003	Foundation Area
" " -20' Grout "						214		131	255	159		83	278	100	151	140	752	555	214	1521	" "
" " -30' Grout "					55	384	964	672	577	806	491	785	778	271	45	103	2473	3019	359	5851	" "
" " -30' Blast "	1787	1974	1929	1858						996	2029	2286		1880			6194	996	7548	14738	Main Quarry
" " -40' Grout "					2699	1974	52	63	100	38	387	662	4311	2032	2240	2352	11984	253	483	16910	Foundation Area
" " -Total Holes	4735	4894	3646	1858	4172	2492	4366	2536	4505	4292	7736	5110	5367	4283	2436	2595	27527	25699	27971	65023	

Test - April 25 - May 25, 1934

16 WAGON DRILLS - 3 MAKES MAIN DAM EXCAVATION AND QUARRY

Fig. 15 . . . WAGON DRILL PERFORMANCE charted to show method of reporting a large amount of information conveniently on one sheet.



DAILY HAULING RATE
(7 Trips per Truck Shift)

No. Cu.Yds.	No. Loads Required	No. Truck Shifts	NO TRUCKS PER SHIFT 1	2	3	4
175	35	5	3	2	-	-
210	42	6	3	3	-	-
245	49	7	3	3	1	-
280	56	8	3	3	2	-
315	63	9	3	3	3	-
350	70	10	3	3	3	1
385	77	11	3	3	3	2
420	84	12	3	3	3	3

Fig. 16 . . . STUDY of truck operating time in hauling sand. Also table of instructions for hauling various loads per shift.

arrival on the job. This sort of record keeps the superintendent from getting into the hole.

Combination Progress and Cost Report — One of the most important charts is shown in Fig. 18. This type of chart may be prepared for any operation running continuously through the job — for instance, the performance of a mixer plant which is here shown. The upper part of the chart shows cumulative production as compared with scheduled production and also the monthly output of the plant. A series of similar charts on all major operations tells the all important story in dollars. Of particular interest is the high cost of operation at the start in getting the plant underway and systematizing operations. The high unit costs at the start are of course also accounted for by the low production and this brings out the important fact that in starting up a new plant every preparation should be made in order to permit production to get up to full capacity as soon as possible.

Of further interest is the experience of June 1935 when a breakdown outside of the plant caused the whole job to operate at only part capacity and the unit cost immediately jumped up. Beginning in August 1935, the job began to wind up and here, again, daily production went down with a corresponding increase in unit cost because the plant was no longer operating at its full capacity and maximum efficiency. When these various points are properly appreciated and anticipated the opportunities for saving money are apparent.

Incidentally such cost charts reveal for future reference the important difference between average costs over the full period of the job and the best costs which are obtained when everything is running at full capacity.

A study of such performance records and interpretation for the benefit of the superintendent and foremen on the job can be handled to best advantage by specially trained technical men who have a thorough understanding of construction costs, machine performance ability and the human element of job operations. Obviously, the superintendent has not the time to make such studies, and the foreman in general does not have the training, nor should he be required to spend his time in making such studies. Where facilities are provided for assembling such information for the purpose of finding out how to improve operations and reduce costs rather than for the purpose of finding out who is wrong, such facilities will pay for themselves many times over.

❖

NEXT MONTH — Chapter 7 of the series on "Heavy Construction", by A. J. Ackerman and Charles H. Locher, to appear in the June issue, will deal with "Cofferdam Construction".

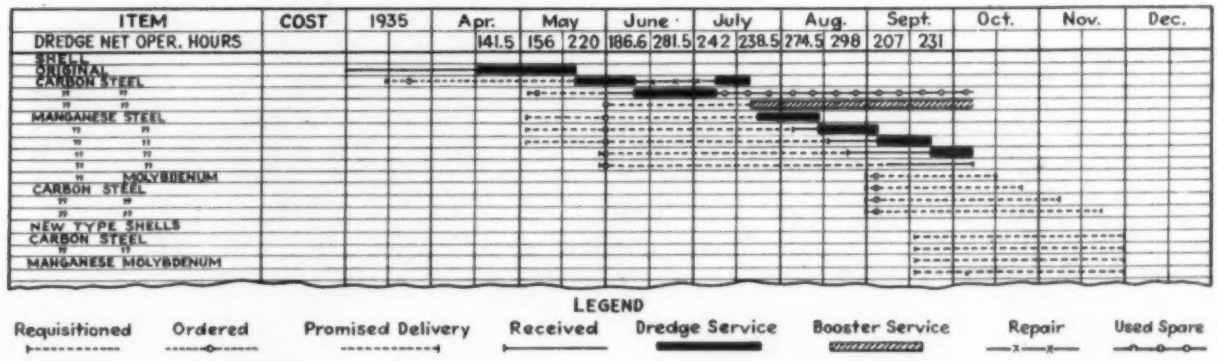


Fig. 17 . . . MAJOR REPLACEMENT RECORD for dredge operations, covering wearing parts and schedules of parts in stock and on order.

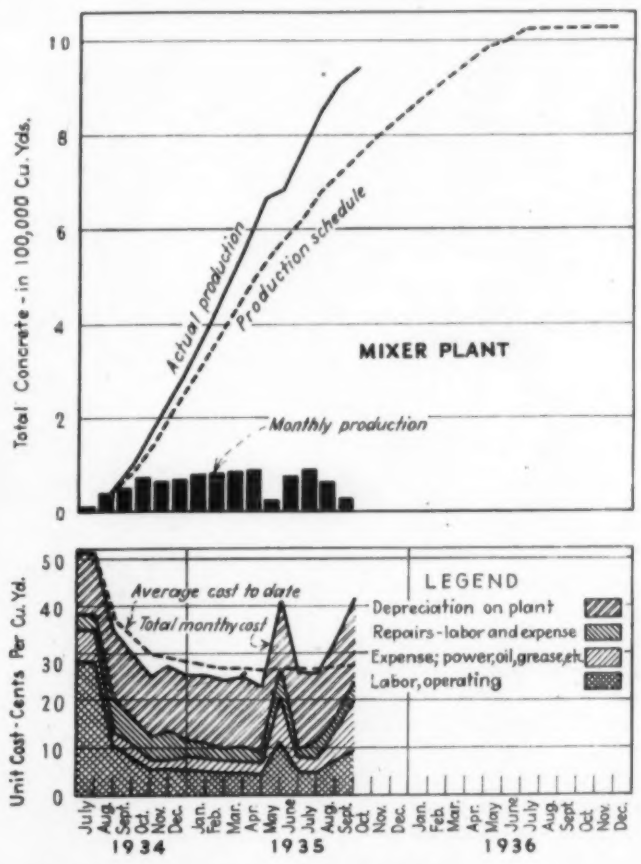


Fig. 18 . . . COMBINATION PROGRESS CHART and cost report for mixer plant.

1 DAMAGED PORTION *(left)* of concrete pavement is demolished and removed from roadway. Highway maintenance crew prepares trench for repair and places form boards at both ends of trench, continuing lines of pavement edges.

Step-by-Step Field Methods

Vibration of Concrete Patch Cuts Traffic Delay to 9 Hours

FOR REBUILDING defective portions of road concrete, State Highway Division 12, Ohio Department of Highways, consisting of Cuyahoga, Lake and Geauga Counties, has thoroughly tested a vibratory method that has proved highly satisfactory and now is preferred over other known processes.

By the new method, fragments of the original pavement are used. By-passing of traffic is minimized, and need of barricades, lanterns and watchmen is largely avoided, reducing traffic interruptions and hazards as well as theft of Highway Department property.

Fifteen repair jobs were charted and completed from Sept. 17 to Oct. 10, 1935, under the direction of R. A. Freese, division engineer, and T. T. Kilfoyle, maintenance superintendent. Accompanying photographs show progressive stages of making a repair with a power vibrator weighing 325 lb. and a power screed weighing 315 lb., both machines owned and patented by the International Steel Tie Co., of Cleveland. The vibrator, with a 46-lb. air motor delivering up to 1,500-lb. impact and turning up to 3,850 r.p.m., performs the double function of mechanically packing the fragments and inducing grout to penetrate all voids.

2 SELECTED FRAGMENTS of original concrete are replaced by hand, larger pieces going on bottom and graduated smaller sizes toward top. Air hose from compressor is used to remove all dust from this course before layer of 1:2½ grout with 2½ gal. of water per sack of cement is placed on rough aggregate.

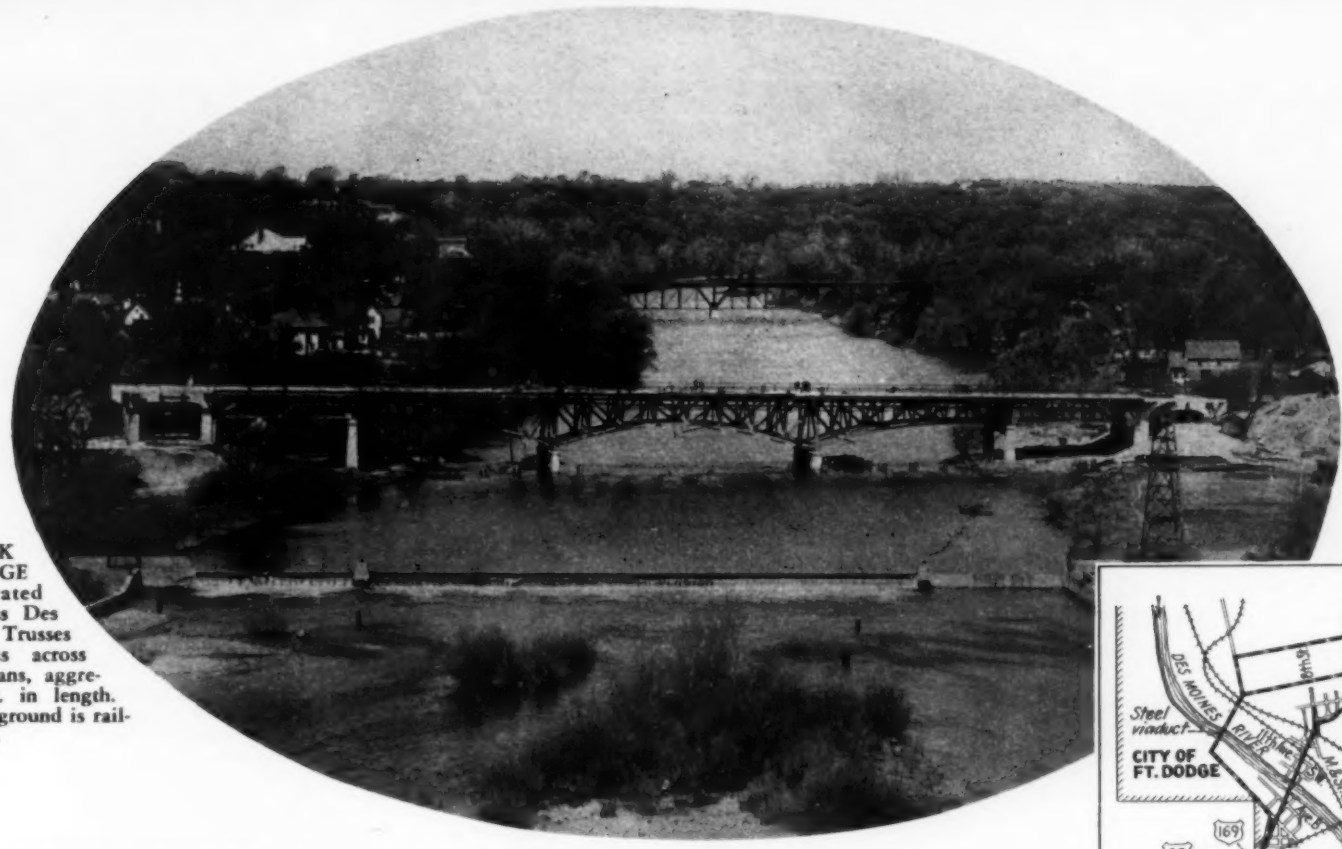
Dry ¾-in. slag and grout later are added alternately as needed to maintain approximate pavement level. The average time of thorough compaction of 1 sq.yd. of pavement 8 in. deep is 6.44 min.; for 1 cu.yd., 29.11 min. To finish the grouted patch, a power screed driven by the air motor previously mentioned, which is interchangeable between vibrator and screed, is drawn slowly across the surface. Slag and grout are applied as needed. Average time of thoroughly screeding 1 sq.yd. of pavement is 1.53 min. Vibration produces sufficient density to permit immediate resumption of traffic, if necessary.

3 POWER VIBRATOR driven at high frequency by air motor develops mechanical pack of rough aggregate and grout, seating fragments of old concrete firmly and causing grout to penetrate all crevices and voids. Vibrator operates ½ to ¾ hr.

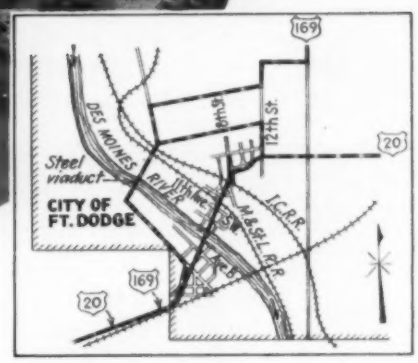
4 LAYER OF ¾-IN. SLAG is placed on grout to depth of about 1 in. and is vibrated down into grout to meet bottom course of rough aggregate. Total mass of vibrated grout and aggregate now is slightly above grade.

5 VIBRATING SCREED drawn across patch by hand or truck compacts top course of slag and grout down to finished grade and removes any excess. Operation is repeated two or three times to get smooth surface finish.

6 SCREEDED PATCH *(in circle at left)* leaves little hand floating or finishing to be done. Patches usually are started at 8:30 a.m., and finished by 2:00 p.m. When weather is favorable for drying, traffic across patch resumes at 5:30 p. m., eliminating need for barriers or lights.



STEEL DECK TRUSS BRIDGE carries relocated highway across Des Moines River. Trusses are continuous across three river spans, aggregating 340 ft. in length. Bridge in background is railroad structure.



HIGHWAY RELOCATION 4,800 ft. long in Fort Dodge, Iowa, transfers U. S. 20 and U. S. 169 from city streets to modern 34-ft. roadway crossing five new bridges. Broken lines indicate existing routes; solid line marks relocation.

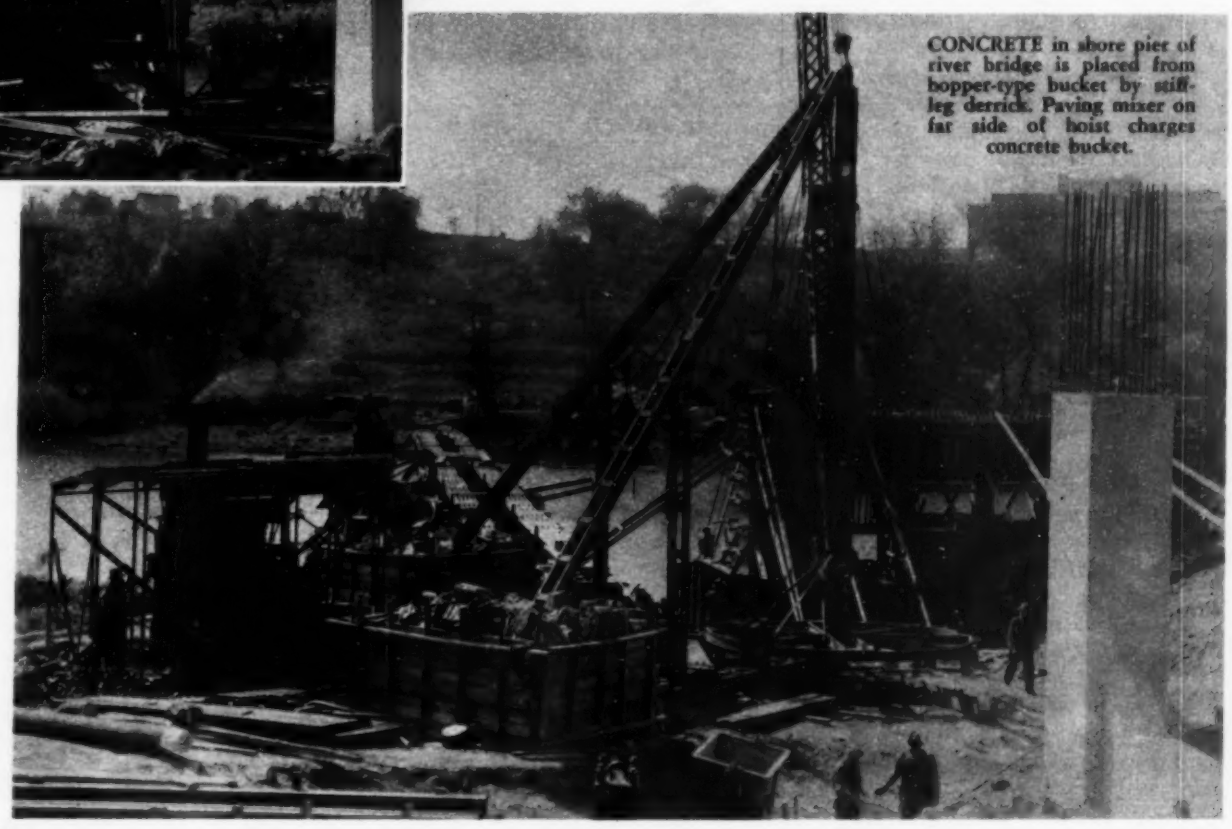
Mile of Highway Relocation Requires

Construction of Five Bridges

COFFERDAM of interlocking steel sheetpiles for river bridge pier is constructed by steam crawler crane which drives piles with hammer in swinging leads.

BY AN IMPROVEMENT 4,800 ft. long involving five bridge structures and 180,000 yd. of embankment, the Iowa State Highway Commission is relocating U. S. Routes 20 and 169 in the western part of Fort Dodge, eliminating a dangerous grade and two sharp turns and transferring through traffic from city streets and an inadequate steel-tower viaduct to an express highway designed in accordance with modern standards of alignment, gradient and safety. Starting at a point about 500 ft. inside the western limit of the city, the new highway descends on a 6 per cent grade to the Des Moines River, which it crosses on a multiple-span deck-truss steel bridge with the three central spans, aggregating 340 ft. in length, designed as a continuous structure. East of the river, a continuous steel-frame viaduct carries the new route across two railroads. Three intersecting streets, one to the west of the river and two to the east, are crossed on concrete arch bridges built on skews ranging from about 10 to 35 deg.

Each of the five structures was set up as an NRM project and was awarded under separate contract. Variation in structural designs and in regulations governing labor methods caused a corresponding diversity in

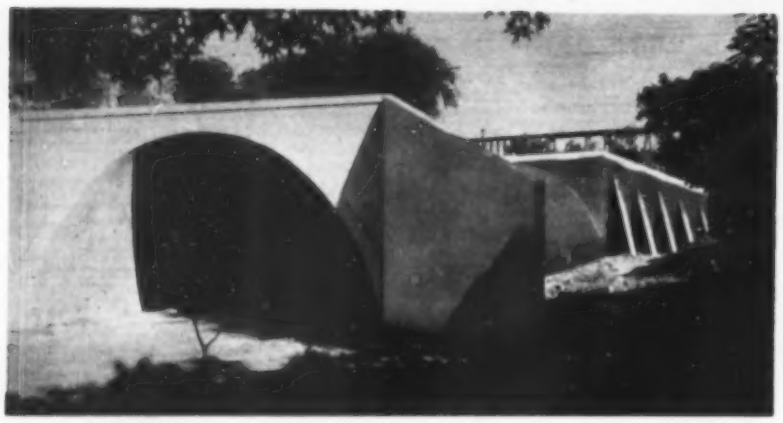


CONCRETE in shore pier of river bridge is placed from bopper-type bucket by stiff-leg derrick. Paving mixer on far side of hoist charges concrete bucket.

construction problems and procedure. For the three arches, all of which are less than 50 ft. in span, hand labor was required in batching and placing concrete. Foundations of the river bridge piers and of one arch go to rock, as do two piers of the long viaduct. All other footings rest on foundations of creosoted timber piles, driven by drop hammer to obtain as closely as possible the designed bearing value of 25 tons.

Highway Relocation — As indicated by the accompanying location plan, the new highway avoids all contact with city traffic until it reaches 8th St., on the north side of the river, where a proposed ramp will connect the elevated roadway with the street. At 8th St. and 11th Ave., S.W., on this side of the river, as well as at Ave. B on the other side, the highway crosses the streets on concrete arches. The arch design was chosen as a logical and economical type of structure to carry the highway embankment at these street intersections. At Ave. B the depth of fill on the center line of the highway will be 18 ft. above the crown of the arch.

PLYWOOD FORMS, paving mixer, and crawler crane driving creosoted timber pile at foot of approach fill in background herald construction of continuous steel frame viaduct crossing M. & St. L. and I. C. Railroads.



COUNTERFORT WING WALLS distinguish arch at Ave. B. Buttresses below ground level on face side of wing walls are not visible.

This arch, 35 ft. 4 in. by 127 ft. in plan dimensions, intersects the highway on a skew of 21 deg., 9 min. Foundations are carried down 13 ft. to sound shale rock. Wing walls are buttressed on the face side up to a level slightly below the ground line and are braced in the back by counterforts extending almost to the top, as shown by an accompanying photograph. The arch has a 20-ft. rise and a roadway clearance about equal to the rise.

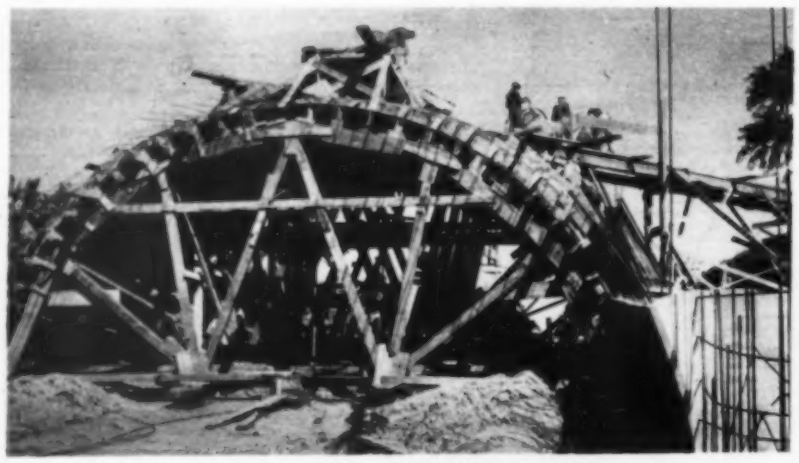
At 11th Ave., S.W., the arch is 40x93 ft. in plan, with a rise of 16 ft. and a clearance of about 18 ft. The skew is 10 deg., 4 min., and the wing walls are battered cantilevers, heavily reinforced. Creosoted pile foundations support this arch and the one at 8th St.

An unusual combination of conditions is encountered at the 8th St. arch. The highway crosses this bridge on a 2.95 per cent grade and a 12-deg., 15-min. curve, with the roadway superelevated ½ in. per foot. Eighth St. itself passes through the arch on a fairly steep grade. As a result of the highway curvature, the south parapet wall of the arch is skewed 31 deg., 55 min. and the north parapet wall 37 deg., 54 min. The arch has a square width of 40 ft. and a length of 80 ft., with a rise and clearance of about 16 ft. Wing walls, of the cantilever type, are curved.

A clear roadway width of 34 ft. between curbs is provided throughout the length of the improvement. On the river bridge and the long viaduct across the railroads, this roadway is flanked by two 5-ft. sidewalks.

A steel deck-truss bridge 480 ft. long with two 40-ft. concrete-frame approaches has been erected under one contract at the river crossing. The three-span 340-ft. continuous-truss portion of this structure is flanked by symmetrical 68-ft. simple truss end spans. A 7½-in. reinforced-concrete deck carries the roadway.

To the north of the river, the relocated highway crosses the 11th Ave. arch and continues uphill on a 5.64 per cent grade by means of a 650-ft. continuous steel-frame viaduct which carries the roadway above the tracks of the Minneapolis & St. Louis and the Illinois Central Railroads. At each end, the viaduct is approached over a 34-ft. concrete-frame abutment. The steel-frame viaduct consists of five 98-ft. girder spans, the girders being designed as continuous members supported by two-column steel bents on concrete pedestal piers. Two central bents are fixed on the piers, but the remaining four bents rest on rollers, as do the end spans at the abutments. A floor framing of intermediate transverse beams and longitudinal stringers carries a 7½-in. reinforced-concrete deck. The girders, beams and joists of the end spans are to be Gunited.



TIMBER FALSEWORK supports forms for half of 8th St. arch. Concrete carts transport fresh batches over elevated runway from mixer.

Foundations — River piers were excavated to rock inside steel sheet-pile cofferdams. Piers for two bents of the viaduct also were carried to rock in sheeted open pits. The rock is a hard shale which remains sound so long as it is not exposed to the air.

For the other piers of the viaduct it was necessary to drive more than 4,000 lin.ft. of creosoted yellow pine piling from 12 to 40 ft. long. Slightly greater quantities of creosoted piling were required for the 8th St. and

R. K. TIMMONS *(below, left)* in charge of work for Welden Bros., and Forest W. Akers, inspector for Iowa State Highway Commission.

E. WELDEN *(right)*, of Welden Bros., watches some concrete go into 8th St. arch.

ELEVATED MIXER chutes concrete into bucket set up as hopper for feeding carts delivering to 8th. St. arch footings.

Where it was impossible to obtain the designed bearing value of 25 tons per pile, the engineers drove additional sticks to make up the deficit.

Concrete Work — Concrete for the river bridge and for the viaduct was produced by a 1-yd. paving mixer to which trucks hauled materials from a batching plant set up beside a railroad spur. At the Ave. B arch the contractor used a 1-yd. paver also; but, because of the hand-labor requirements, the batches had to be dumped on to a platform by the truck and shoveled into the mixer skip by hand. Concrete was distributed from the mixer in hand carts.

In building the 11th Ave., S.W., arch, the contractor for this structure utilized a similar paver set-up for the footings but substituted team methods in distributing the concrete, hauling the material in two-wheel horse-drawn carts. Arch concrete was produced by a two-bag mixer and was placed with hand carts. At 8th St., the contractor used a two-bag mixer and hand carts. A number of the accompanying photographs illustrate operations at this structure.

Plywood forms were utilized by all the contractors for exposed concrete work to obtain a smooth surface and reduce finishing costs. Rubbing of the intrados of arch barrels was not required, but rubbing was required on exposed work elsewhere.

In the footing mixture, the proportion of sand by weight in the total combined aggregates was 40 per cent, and the cement content in the mix was about 1.60 bbl. per cubic yard. For greater workability in the structural concrete the proportion of sand by weight was increased to 45 per cent of the total combined aggregates, and the cement content was stepped up to 1.66 bbl. per yard. Gravel was the coarse aggregate used in most of the structures, but the contractor on the 8th St. arch purchased crushed limestone of high specific gravity from a mine about 3 mi. west of the city.

Contractors and Progress — Total value of the contracts for the five bridges exceeds $250,000. The Des Moines Asphalt Paving Co., of Des Moines, general contractor for the river bridge, started work on this project July 31, 1934, and completed the contract Aug. 1, 1935. Structural steel amounting to almost 400 tons was furnished under subcontract by the Pittsburgh-Des Moines Steel Co. The same general contractor built the Ave. B arch, starting work March 12, 1935, and completing the waterproofing Aug. 1, 1935.

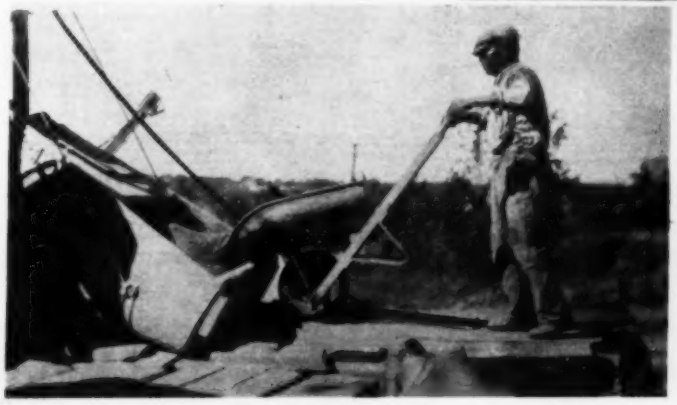
Construction of the long overhead viaduct was begun Aug. 12, 1935, by the Wisconsin Bridge & Iron Co., of Milwaukee, Wis., general contractor. A completion date of June 1, 1936, is set by the contract. The Des Moines Asphalt Paving Co. is acting as subcontractor for labor only on the concrete work, the value of the subcontract being limited by the regulation that the general contractor must perform 80 per cent of the work.

Contracts for the arches at 11th Ave., S.W., and 8th St. were awarded respectively to the C. E. Larsen Construction Co., of Fort Dodge, and to Welden Bros., of Iowa Falls, Ia. The former started operations Oct. 23, 1934, and completed the 11th Ave., S.W., bridge June 15, 1935, and the latter began work on the 8th St. arch July 30, 1935, and had the structure accepted Nov. 17, 1935.

Of the 180,000 cu.yd. of fill required for the highway embankment, more than 100,000 cu.yd. has been placed by relief labor, which excavated the material from borrow pits on both sides of the river. Light trucks hauled the material from the pits to the embankment. A cut at the west end of the relocation will provide most of the additional earth needed for the fills.

Administration — F. R. White is chief engineer for the Iowa State Highway Commission, and F. H. Mann is assistant chief engineer. Under the general supervision of W. F. Beard, district engineer, the work in Fort Dodge is directed by W. W. Winslow, resident engineer.

FRANK VICKERY, superintendent, Des Moines Asphalt Paving Co., watches creosoted pile as it approaches desired bearing value.



PNEUMATIC TIRES *(right)* and scoop-shape bodies increase efficiency of wheelbarrows for aggregate handling on Welden Bros. contract.

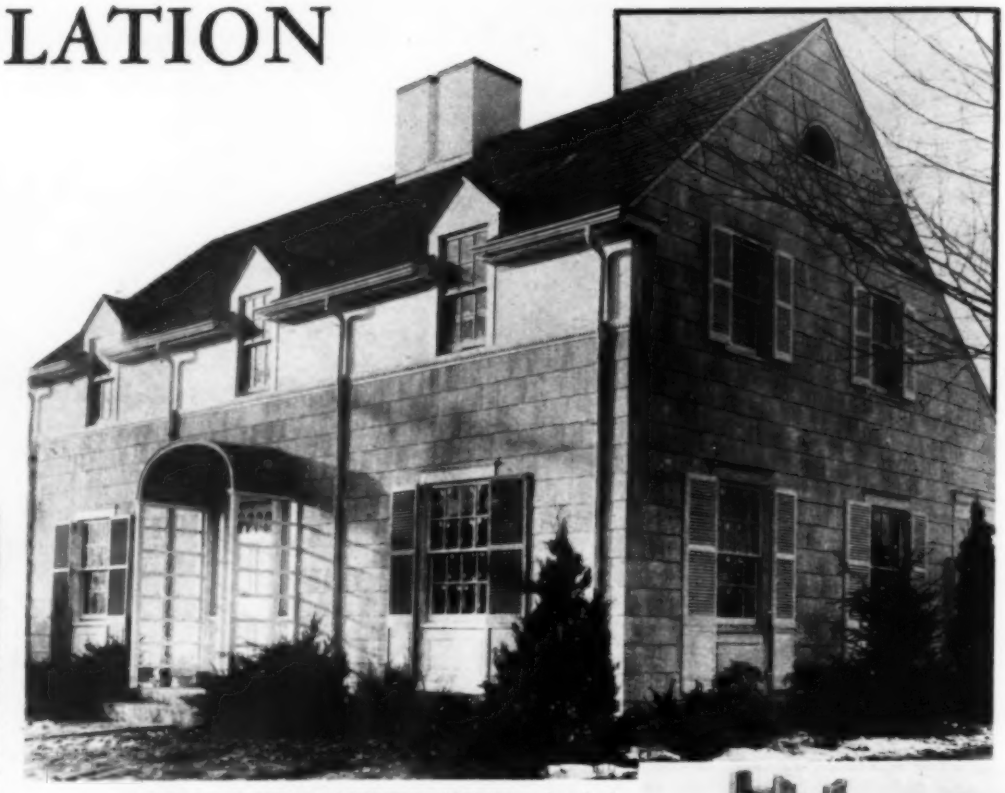
EASIER LOADING of aggregate dictated choice of this type of shovel *(left)* by Welden Bros.

RAY AMOS *(below)*, inspector for Iowa State Highway Commission.

TRIPLE INSULATION

Built Into New

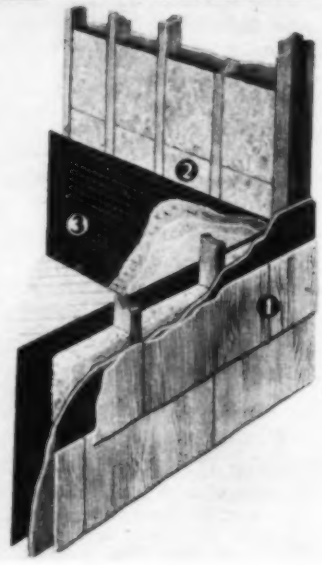
"ASBESTOS HOUSE"



WESTCHESTER'S "ASBESTOS HOUSE," sheathed to insure protection against fire and weather and insulated against temperature, hot or cold.

PAPER-BACKED WIRE MESH provides base for applying plaster to interior walls and partitions.

WALL INSULATION against both heat and cold is provided by rock wool bats, 4 in. thick.

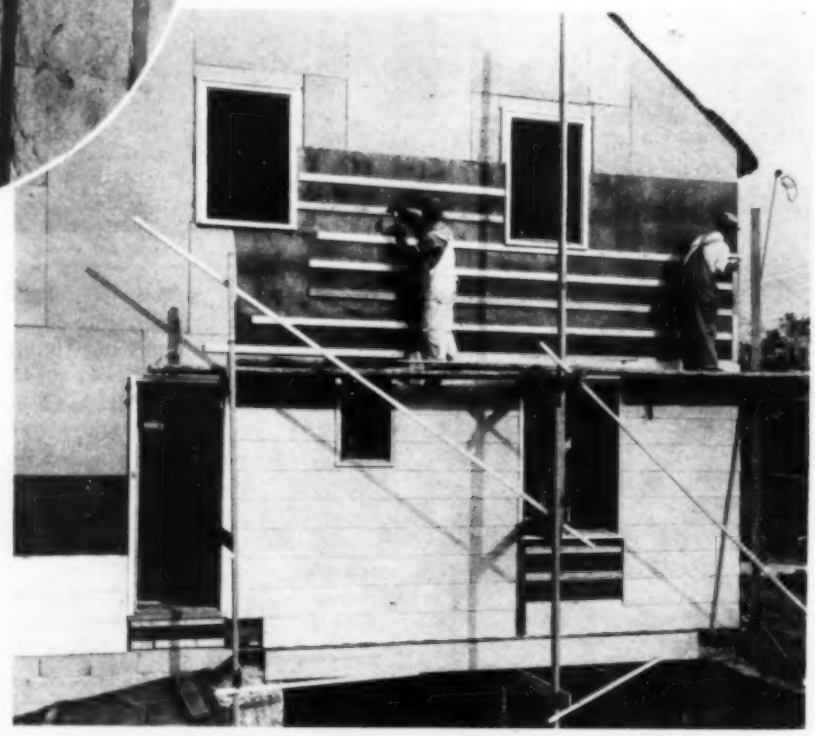


WALL DETAIL *(right)* showing triple insulation construction. (1) Asbestos siding shingles; (2) rock wool bats; (3) paper-backed wire mesh for plaster base.

BY THE USE of asbestos-cement shingles for roofing and siding, rock wool within wall spaces and second story ceilings, and paper-backed wire mesh to serve as a plaster base for interior wall surfacings, triple insulation is provided in the new 8-room, Colonial type house which Oscar A. Ettari, operative builder, has constructed at Wykagyl Crossways, a Westchester County community under development near New Rochelle, N. Y. For the type of construction employed the advantages claimed are fireproofness, equalization of interior temperatures during both hot and cold weather and structural durability. The various insulating materials in the new structure are all Johns-Manville products.

The accompanying illustrations indicate the several insulating features of the house. For the roof, textured shingles of a fireproof and weatherproof asbestos and cement composition are used. Exterior walls are sheathed with cedar-grain gray-colored asbestos-cement siding shingles, backed by insulating board nailed to the timber studding which carries on the inside, sheets of paper-backed wire mesh forming a plaster base. The intervening wall space, 4 in. wide, is filled with rock wool insulating bats, which are also inserted underneath the roof area.

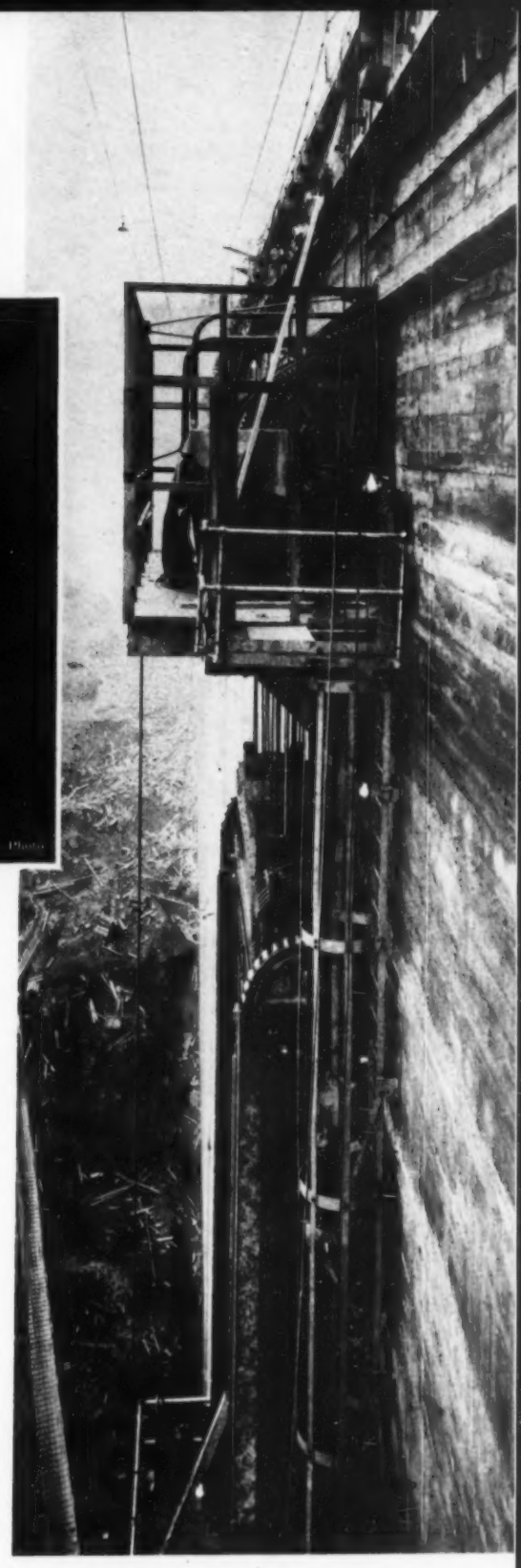
Rock wool insulation used between the studs in the walls is rot-proof as well as fireproof. By filling the wall spaces with a fireproof material this type of construction prevents the walls from acting as flues to spread fires that start in the lower part of the house. The insulating effect of the rock wool blanket serves to keep the interior of the house 10 to 15 deg. cooler on hot summer days and likewise reduces winter heating costs by an appreciable amount.

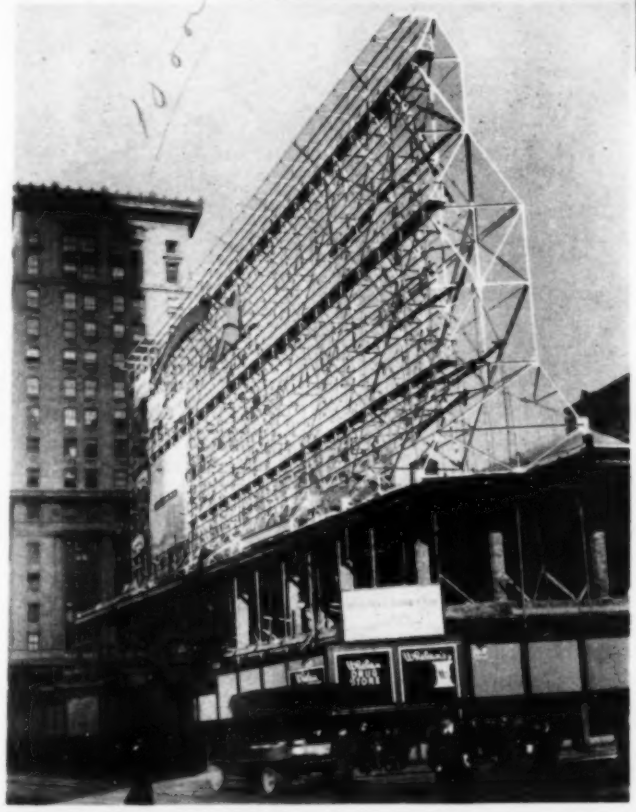


FURRING STRIPS are nailed over insulating board sheathing and asbestos roofing felt to form base for grained shingle siding.

BIGGEST ELECTRIC SIGN, 188x75 ft., extending entire length of city block involves erection of 140 tons of structural steel framing *(below)*, to illuminate New York City's Great White Way at Broadway between 44th and 45th Sts. Steel framework was erected by Charles Welker, of Long Island City, for Peerless Iron Works, general contractor. Sign is atop new two-story building for which Hegeman-Harris Co. is general contractor. The sign carries 1,084 ft. of neon lighting tubing and 29,508 lamp receptacles. Largest fish on sign measures 42 ft. in length. Actually gigantic multi-colored fish, appearing to glide among waves of sea-green light, are stationary, the illusion of movement being created by flickering lights on the fishes' scales, the waving fins and the running movement of the waves.

HUGE TRACTOR GATE *(right)* on upstream face of Norris dam, one of two similar units installed by Tennessee Valley Authority to close two penstocks leading through dam to power house. Two tractor gates at Norris dam, each weighing 121 tons, are largest of this type now in use.





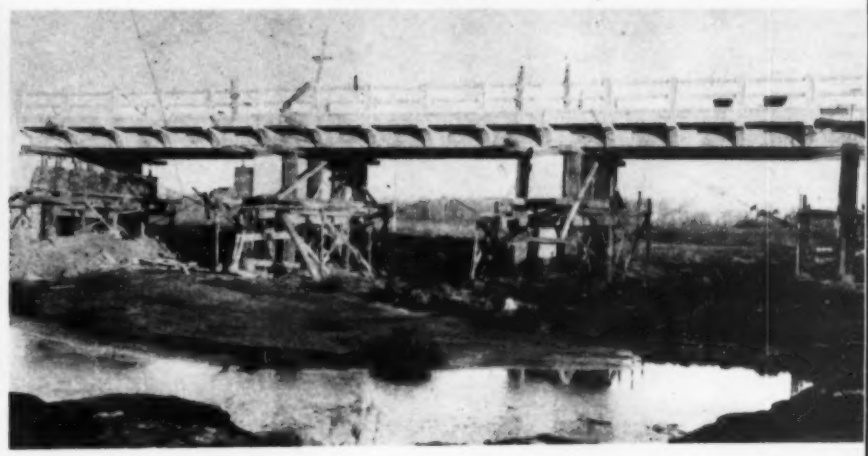
JOB ODDITIES

A MONTHLY PAGE OF

Unusual Features of

Construction

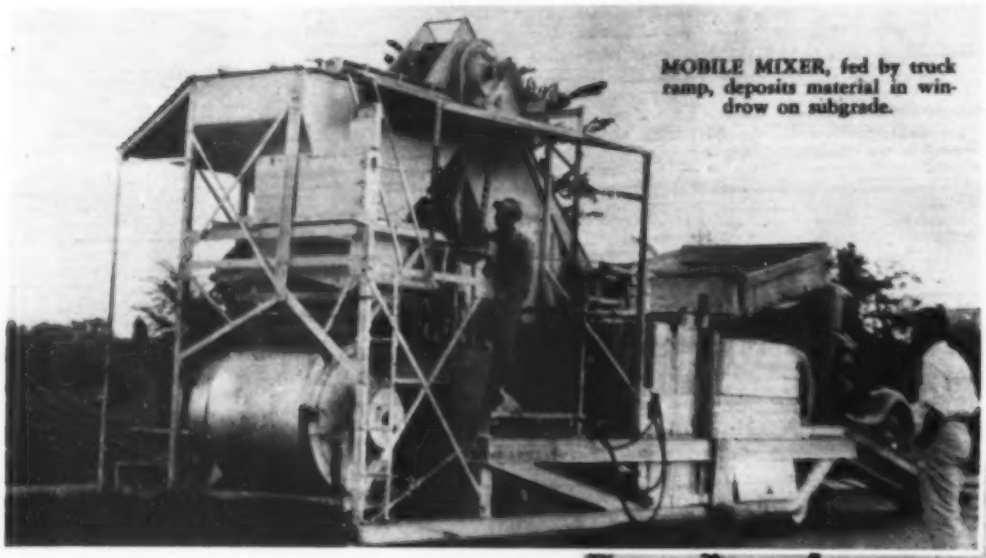
TENNIS ATOP RESERVOIR *(left)*. Roof of water supply structure at Beverly Hills, Calif., is utilized for layout of nine concrete courts, built with PWA funds at cost of $29,000.



BRIDGE DECK RAISED by jacking is supported by 3 ft. of new concrete on old pile caps to place it above high water level of overflow from Republic River at Clay Center, Kan. Approaches washed out by floods, have not yet been replaced.

Moving Machine

Lays Asphalt Mix in Windrows



MOBILE MIXER, fed by truck ramp, deposits material in windrow on subgrade.

WINDROW *(right)* of asphaltic cutback mix is deposited by mobile machine in continuous ribbon.

SPREADING *(left)* of asphaltic mix in windrow is done by blade grader.

FOR MIXING bituminous material and aggregate for highway surfacing and depositing it in a continuous windrow for subsequent spreading on the subgrade, a mobile machine of the batch type, moving along the roadway, was developed in connection with the paving of Ward Parkway, a double-roadway boulevard extending through the Armour Hills district of Kansas City, Mo., a development made by the J. C. Nichols Co.

When the development was first opened the Nichols company installed curb and gutter and a hand sledged stone base on the east driveway of Ward Parkway, giving it a seal coat of oil to keep it from raveling. The base was laid at a grade approximately 2½ in. below the gutter to allow for an asphaltic surface coat later. Last summer A. N. Mitchell, engineer in charge of construction for the company, developed a portable machine for mixing asphaltic material and aggregate on the site of the work. The surfacing of Ward Parkway was performed with this new machine.

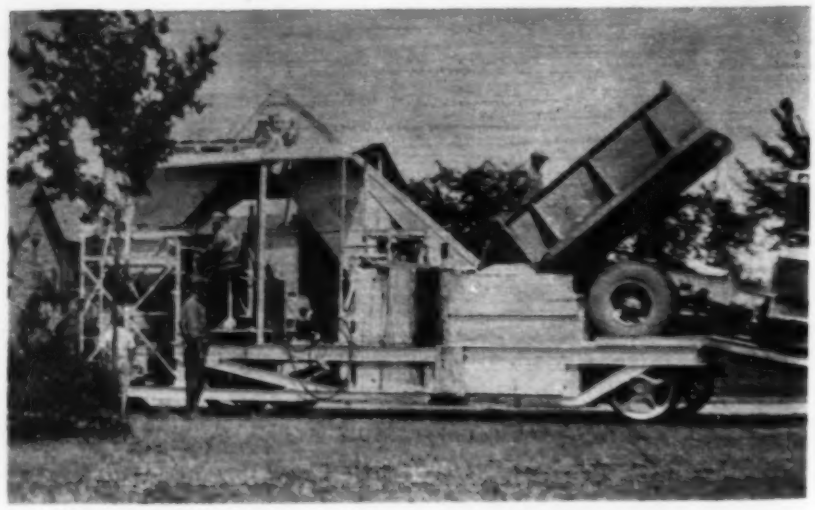
The machine is of the batch type, moving down the roadway and depositing the mixed material in a windrow back of it. The outfit is equipped with a ramp on the forward end, used by trucks for backing up and dumping aggregate into a storage bin while the machine is in motion. From the bin a bucket conveyor carries the aggregate up to a hopper above weighing boxes. After it is weighed the material is dropped into a cylindrical mixer with rotating blades. Texaco cutback asphalt, carried in a tank near the front end of the mixer, is proportioned by volume and discharged into the mixing chamber through a pressure coil.

The cutback asphalt for this work was furnished by the Midwest Paving Co., of Kansas City. This organization has storage tanks in which the asphalt is maintained hot; the Nichols company sends its trucks to these tanks and delivers the hot material to the mixer tank. The mixer tank is provided with an oil burner in order to maintain the temperature of the cutback asphalt at the proper working degree of heat.

The street to be improved was approximately 1 mi. long and 40 ft. wide between gutters. The surface was laid in two courses. On the base course approximately 173 lb. per square yard of limestone aggregate, ranging in size from ¼ to 1½ in., was mixed with approximately 1.57 gal. of cutback asphalt per square yard. For the second or top coat, 74 lb. of limestone, ranging in size from ¼ to ¾ in., was mixed with 0.67 gal. of cutback per square yard. After the surface was laid and rolled, a light emulsified asphalt seal coat covered with Merimac gravel was applied. The crushed limestone was taken directly from the bins at the crusher and delivered into the mixer bin, no uncoated aggregate at any time being dropped on the street.

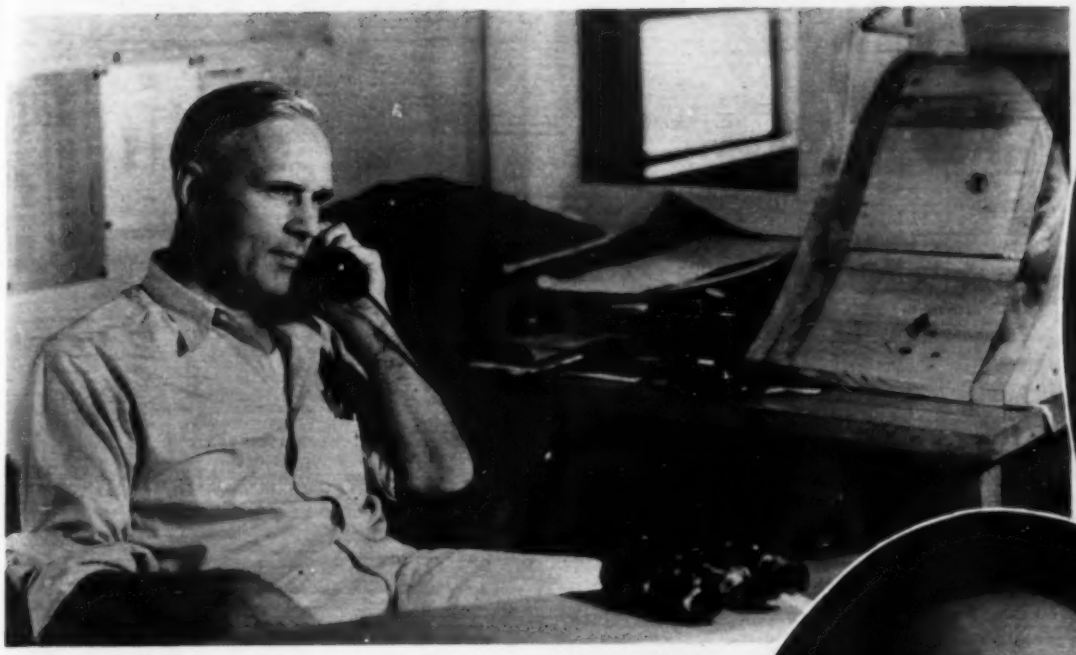
The mixed aggregate, windrowed in the center of the street when discharged from the mixer, was spread with power blades and then thoroughly rolled. Hand spreading was done only around curves at intersections.

RAMP *(left and below)* on front end of mixer allows trucks to mount machine while in motion and discharge aggregates for asphaltic mix.



Present and Accounted For

A PAGE OF Personalities



DAM BUILDER George P. Jessup now divides his time between two TVA projects, Wheeler dam and Guntersville dam, on Tennessee River, for both of which he acts as construction superintendent. His record includes supervision of construction at Baker River dam in Washington, Conowingo project on Susquehanna River, and Osage power development at Bagnell, Mo.

Harris & Ewing

CONSTRUCTION ECONOMIST Lowell J. Chawner *(above)* is chief of new Construction Economics Section established in Bureau of Foreign and Domestic Commerce. Department of Commerce, Washington, D. C., to study business problems of construction industry.

Harris & Ewing

COLORADO CONTRACTOR G. W. Hamilton *(below)*, of Hamilton & Gleason, Denver, was reelected president of Colorado Association of Highway Contractors at annual convention in Denver, Jan. 27.

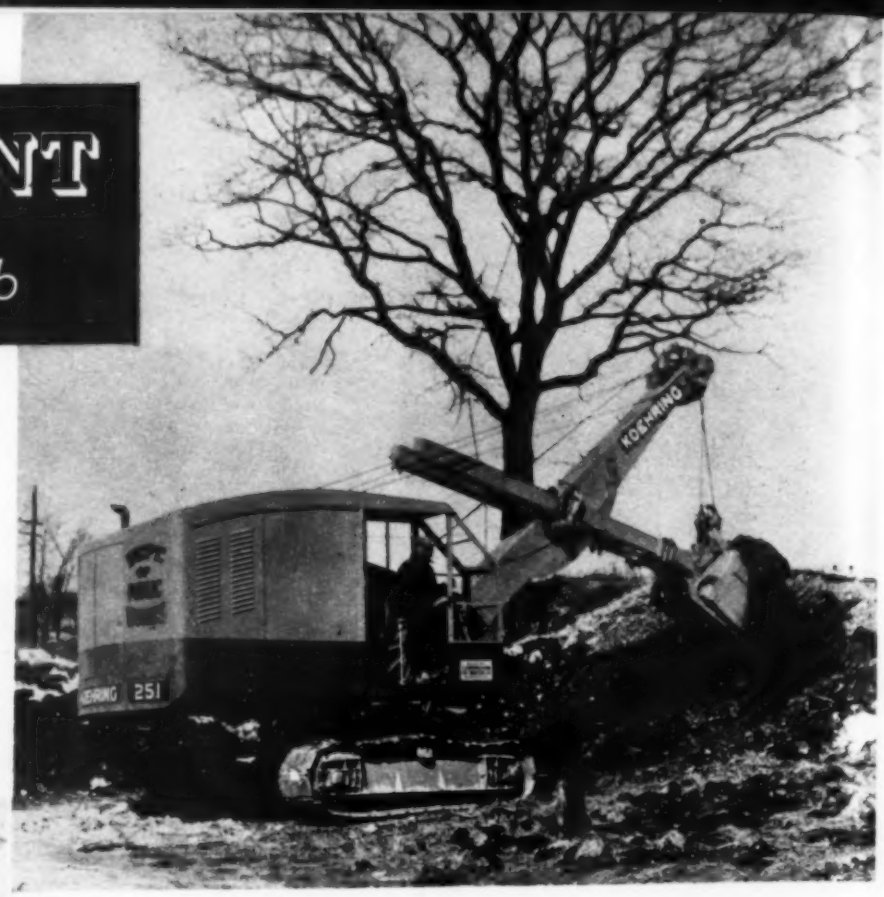
DESIGNERS AND BUILDERS *(left)* of Cleveland's Cedar-Central PWA housing project, described in *Construction Methods*, April, 1936, pp. 30-32, are (beginning at extreme left) George L. Craig, project manager for PWA; Walter Ray McCornack, architect; and Frank E. Warren, construction manager for George A. Fuller Company.

CONSTRUCTOR AND ENGINEER A. E. Horst, secretary-treasurer and general manager of Henry W. Horst Co., Philadelphia, recently became chairman of executive committee in construction division of American Society of Civil Engineers.

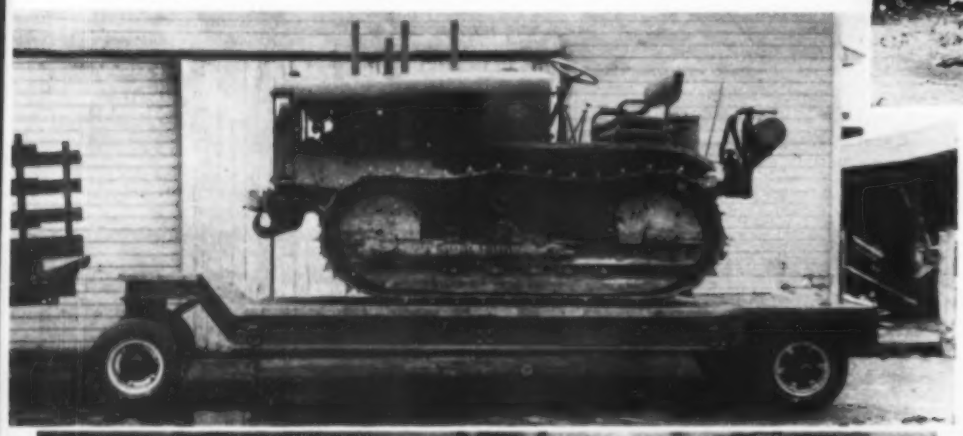
NEW EQUIPMENT

On the Job

HIGH SPEED, great operating ease and exceptional traction and steering flexibility are qualities claimed for this new ⅝-yd. convertible shovel *(right)*. Use of special steel, all-welded construction and simplified design have produced strong machine of light weight. Has a ¾-yd. rating as dragline. Attachments for various uses easily and quickly made on job. Simple gear shift provides two selective swing speeds which best synchronize with arc of swing and height of lift for increased output. Two traction speeds give greater power in tough going and faster travel in moving about. Other advantages: (1) Full vision from cab for operator; (2) safety glass; (3) easy access to all parts; (4) inclosed gears; (5) anti-friction bearings—Koehring Co., 3026 W. Concordia Ave., Milwaukee, Wis.

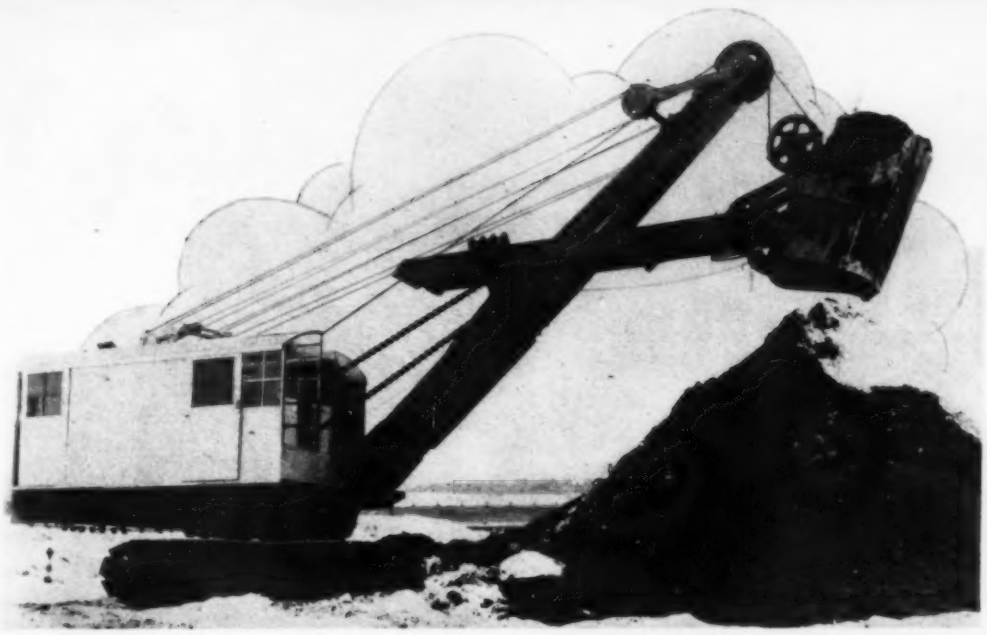


MACHINERY TRAILER *(below)* for transporting shovels, tractors, road-rollers and other construction equipment. Two sizes: Four-wheel designed for loads up to 12 tons and six-wheel for loads up to 18 tons. Four-wheel trailer has rigid mounted rear axle; six-wheel has two independent, oscillating-type rear axles so arranged that four-wheels adjust themselves to irregularities of road, each wheel carrying full share of load at all times. Both models feature oscillating front axle, eliminating necessity of front springs and making turning easier. Loading height, 29 in. Trailer width, 8 ft. Solid or pneumatic tires.—C. R. Jahn Co., La Crosse, Wis.



SIMPLICITY AND COMPACTNESS are points stressed in descriptions of this new line of self-priming centrifugal pumps *(right)*. Pump and engine are unit assembly. Pump impeller is mounted on end of extended engine crankshaft, making bearingless pump. Pump case is bolted directly to engine block. Equipped with engines of ample horsepower and with accurately balanced impellers to assure faster priming time. Built in five sizes; from 2 in. to 4 in. with 3- to 15-hp. engines and with capacities of from 10,000 to 36,000 g.p.h., all ratings being taken at 10-ft. total head. All sizes provided with "slide-away" handles, reducing dimensions for close quarters. — Novo Engine Co., Lansing, Mich.

VACUUM DUST CONTROL in rock-drill operations is made possible by "Drill-Vac" stationary or portable unit *(right and above)*, which consists of metal cap or hood placed against face of rock through which drill steel is inserted. Hood is connected to primary and then to secondary separator and vacuum producer by flexible hose lines. Primary separator can be used either for wet or dry drilling. Portable unit consists of bag filter or secondary separator, where final particles are collected, and electric or air-operated vacuum producer mounted as a single unit. Has capacity of two drills and weighs 200 lb. Stationary and semi-portable units available in capacities up to 50 drills and with electric or gasoline-engine drive. Semi-portable unit mounted on heavy-truck chassis. Dust from drill without hood *(above)* is eliminated when hood is used *(right)*.—The Spencer Turbine Co., Hartford, Conn.

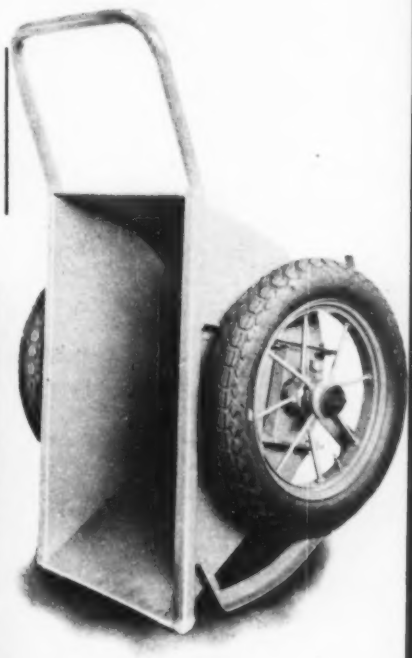


2-CU. YD. DIESEL SHOVEL, designed to take advantage of new alloy-steel and arc-welded construction and diesel power. Emphasis laid on cutting off all unnecessary pounds, reducing inertia to minimum and obtaining higher ratio of horsepower per pound of weight. Heavier construction of P&H swing and crowd mechanisms provide strength and weight to carry greater power furnished by diesel engine. Permits faster digging speeds and ample power carry-over to prevent stalling motor in hard going. Powered by 8-cylinder, Fairbanks-Morse 4-cycle diesel engine rated at 165 hp. at 1,200 r.p.m. for burning cheaper grades of fuel oil. Gasoline power also available.—Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.

If You Want Further Information—

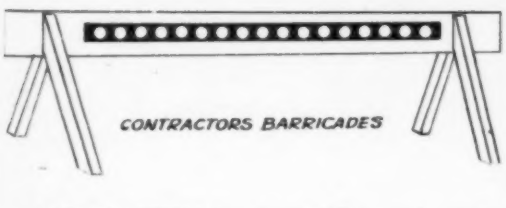
Within the space limits of this page it is impossible to present complete information about the products illustrated.

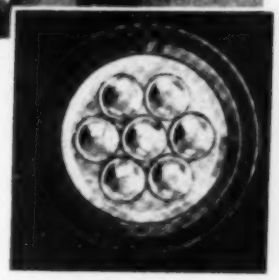
The manufacturers, however, will be glad to supply further details if you will write to them.



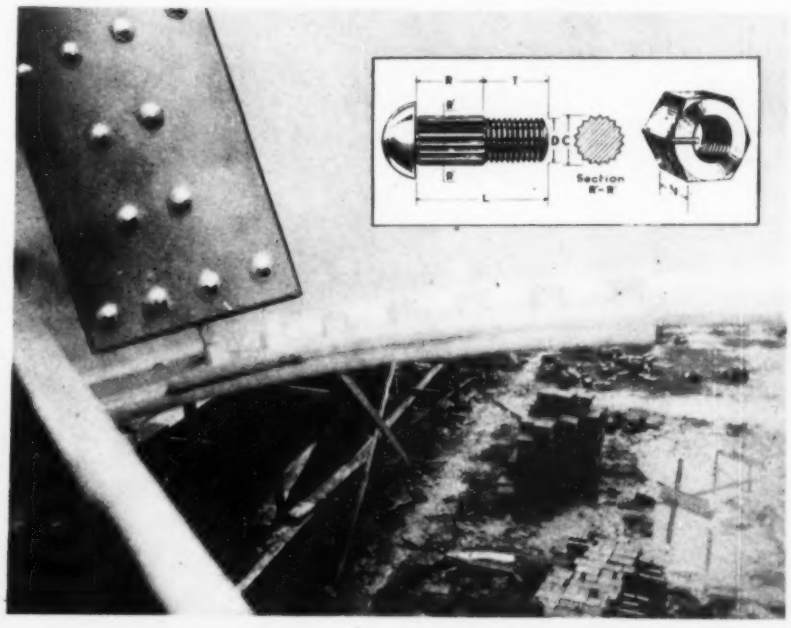
DUMPING ROCKERS provide for this pneumatic-tired cart clean dumping feature of 42-in. steel-wheel cart, with added security against rolling while in dumping position. Rockers make it possible to dump cart easily from end of ramp. All-welded tray is amply reinforced and entirely free of obstruction. Stub axles carried in frame welded integrally with tray. Equipped with pneumatic tires and roller bearings. Capacities, level full, 6 and 12 cu. ft.—Insley Mfg. Co., Indianapolis.

IMPROVED PRESSURE DISTRIBUTOR *(right)* has following new features: (1) Larger Viking positive pressure pump with 4-in. inlet and outlet connections; (2) 4-in. valve provided with 4-in. openings to correspond to those of pump; (3) new type of fifth wheel drive for truck tachometer has 16x4-in. pneumatic-tired wheel with angle-type drive (no exposed gears); (4) 3-in. opening, quick-acting gate valves used on manifold bar so that distributor may be filled from either side and one-half of spray bar or one hand spray may be used; (5) air cleaner on air blower; (6) new type of clutch on blower and fuel pump drive; (7) all pipe connections either flanged or welded, eliminating leaky joints.—Littleford Bros., 443 E. Pearl St., Cincinnati, Ohio.





SAFETY SIGNAL known as Reflectostrip, for use on construction work, dead-end barriers, bridges, guard rails, poles, head-room indicators and contractors' barricades, consists of 5-ft. strips of 16-gage rustproof steel 1⅝ in. wide by ¼ in. thick, finished in black and surmounted with cluster buttons of seven reflectors each, eight buttons to a foot. Buttons may be ordered in red, green, amber or crystal and are protected from weather by Parkerized rustproof closure disks. Reflectostrip is illuminated by approaching headlights of motor cars and trucks and is said to serve as economical, as well as effective, safety signal. May be purchased by foot or other lengths.—Traffic Equipment Corp., 557 W. 42nd St., New York City.



STRUCTURAL RIB BOLTS and automatic nuts used in erection of buildings, bridges, tanks, towers and cars are said to result in saving over cost of rivets and of labor and equipment. Made of carbon manganese steel, minimum tensile strength, 70,000 lb. per square inch, with standard button head and triangular shaped ribs which embed themselves in walls of hole. Nuts also are standard, will fit any bolt and are locked and unlocked by use of ordinary wrench. Galvanizing does not affect locking feature. Spacing is same as for rivets. Rib bolt is driven through hole with hand hammer or sledge, and nut is drawn tight with wrench. Eliminates objectionable noise of riveting hammer and cost of replacing condemned rivets. — Automatic Nut Co., Lebanon, Pa.

Generals Help Speed Work on $3,000,000 Dam

NO DELAYS ON PINE VIEW DAM WITH GENERALS

WORK ON THE $3,000,000 Pine View Dam in Ogden Canyon, Utah, is being rapidly pushed to completion.

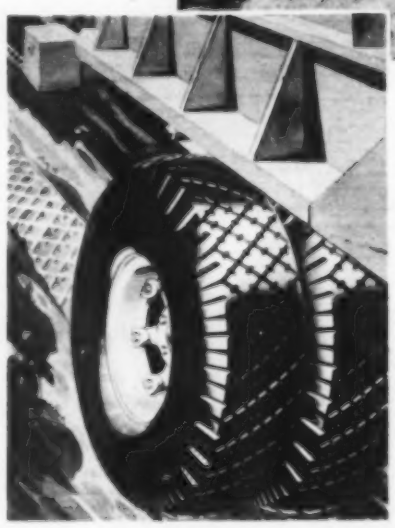
Mr. Len Malan, of the Wheelwright Construction Company, Ogden, reports, "We are using General Tires on the trucks for this construction job. Our particular task is the construction of highways on either side of the reservoir, including the excavation and relocation of the roads. This calls for moving thousands of cubic yards of dirt. General Tires are holding up well on the rough roadwork and have occasioned *no delays on the project.*"

Wherever the jobs are toughest, you'll find Generals. Your General Tire dealer has a complete, highly specialized line of truck tires. He is a practical truck tire man with wide experience and accurate knowledge in fitting the right type and size of tire to every kind of job. This combination is worth real money to you. Call him in.

●

THE GENERAL HEAVY DUTY TRACTION BALLOON

is made to order for the toughest construction jobs. It is only one of the complete line of Generals—each designed and built specifically to do a certain job better.



THREE REASONS WHY GENERALS ARE MORE PROFITABLE TO YOU

1. Generals are stronger tires—additional full-width plies of powerful cord are anchored bead to bead—with no "idle" plies—no floating breaker-strips.

2. Generals are cooler tires—they flex uniformly without that heat-producing "hinging action" of ordinary breaker-strip tires.

3. Generals have "compact rubber" treads—their construction keeps the tread rubber compact and compressed so that it wears slowly and gives more miles.

FREE!

Read this booklet on how to avoid the more expensive tire troubles. Write to The General Tire and Rubber Co., Akron, O., in Canada—The General Tire and Rubber Co. of Canada, Ltd., Toronto, Ont.

GENERAL TRUCK TIRES

SURFACE YOUR SECONDARY ROADS WITH LONG WEARING, ALL-WEATHER, LOW COST

STABILIZED MIX

Above — Overburden screening unit delivering sand-clay mix to trucks at pit, New Hudson, Michigan.

Above right—Plant mixed stabilized material on road ready for spreading and shaping.

A boulevard for only a little more than the cost of a "Mud-Dust" Road

IN almost every section of North America, ordinary earth deposits may be found with which to build the finest highways in existence, excepting only the permanent type pavement.

Hundreds of years ago, Romans built the Appian Way, still in use after 2100 years. The ancient Incas of Peru did much the same thing with a highway nearly 3000 miles long. Science now shows that these roads, by accidental mixtures of certain soils, crushed stones, clay and fine materials, were much the same as the stabilized roads of today.

We now know exactly what soils to put together and how much of each to use to build even better roads than those of the old Romans. It is fortunate that the ingredients needed for these fine highways are common dirt, such as sand, clay, gravel, stone, etc. The secret lies in the amounts of each to use, the size of particles, and a uniform moisture content maintained with calcium chloride.

Since the ingredients differ little from the composition of the ordinary dirt and gravel road, the materials are naturally plentiful and inexpensive. A fine boulevard built by the "stabilized" method costs little more than the ordinary loose gravel highway. Every highway engineer, official and maintenance man should write for our technical bulletins on how to find, test, select and prepare soil materials for every highway not requiring concrete pavement. The literature is free. Write today.

Calcium Chloride Association

MICHIGAN ALKALI COMPANY
60 E. 42nd St., New York City

SOLVAY SALES CORPORATION
40 Rector St., New York City

THE COLUMBIA ALKALI CORPORATION
Barberton, Ohio

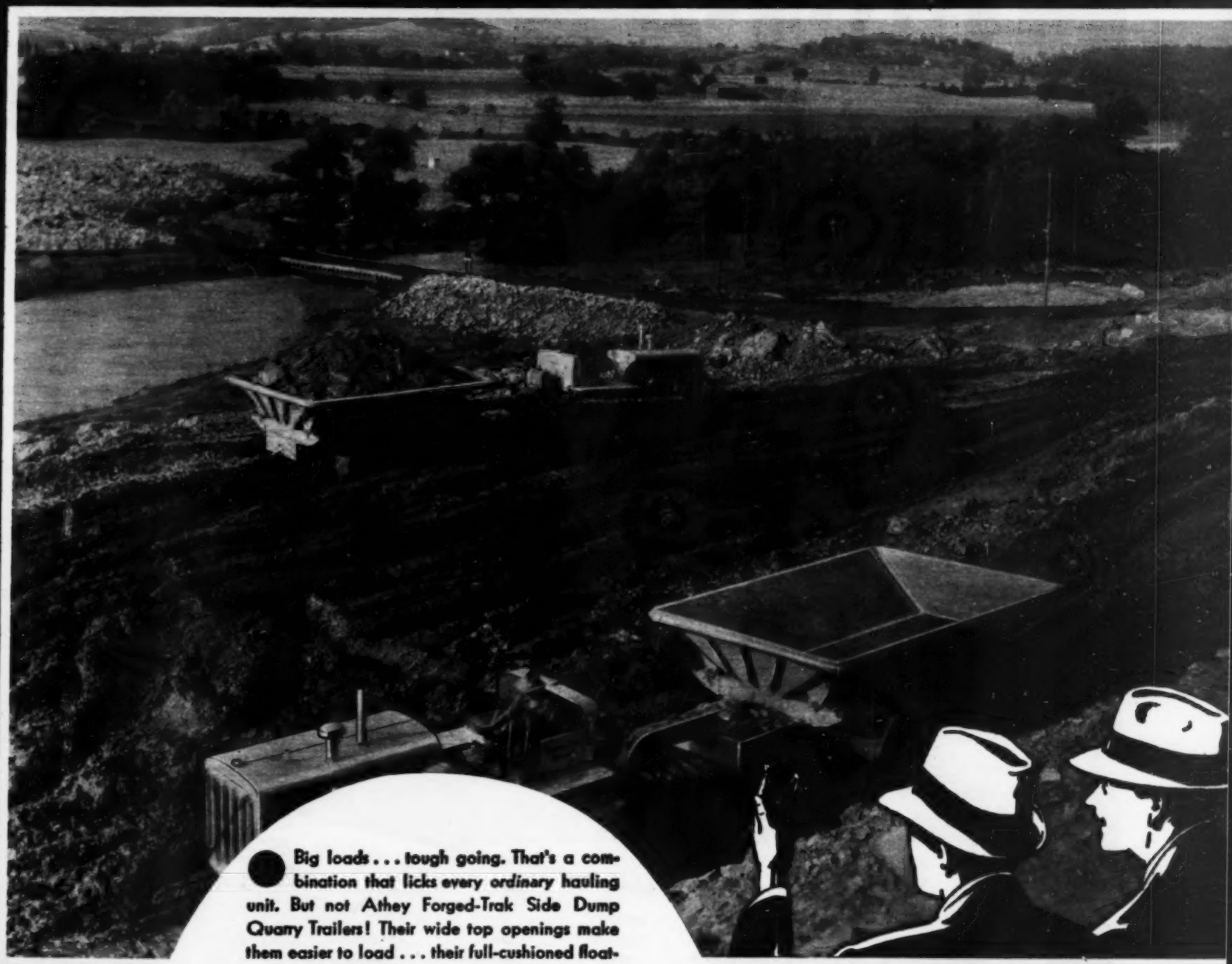
THE DOW CHEMICAL COMPANY
Midland, Michigan

CALCIUM CHLORIDE

FOR STABILIZING ROAD SURFACES

First Choice

WHEN THE JOB MUST *GO ON*

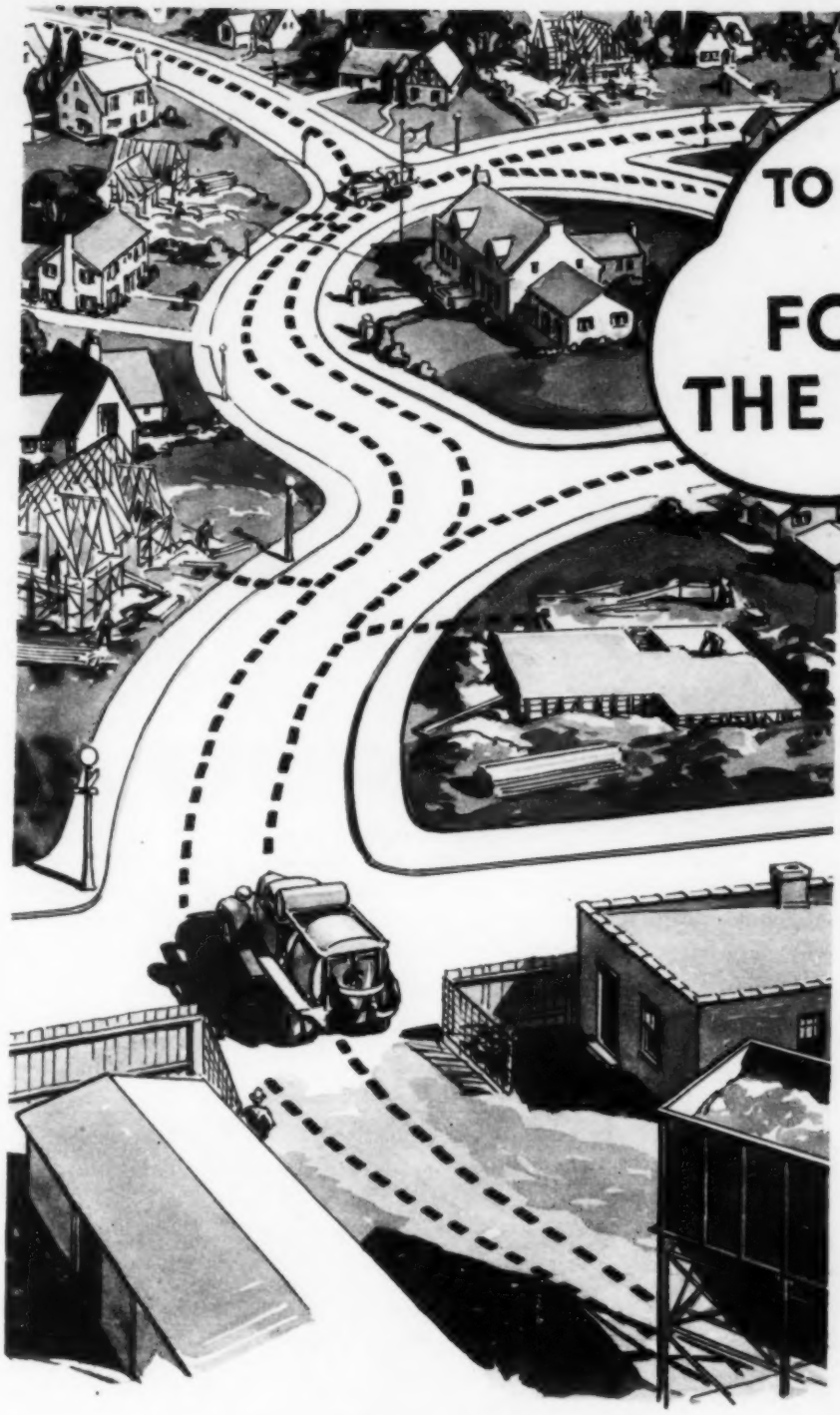


Big loads . . . tough going. That's a combination that licks every *ordinary* hauling unit. But not Athey Forged-Trak Side Dump Quarry Trailers! Their wide top openings make them easier to load . . . their full-cushioned floating drawbars absorb the shocks of loading and roading. Self-cleaning Forged-Trak Wheels get them through sand and muck — keep your loads on the move. Quick, fast dumping, too, whether you're hauling rock, dirt or mixed materials. All this means just one thing: LOWER COST PER YARD. Prove it on your own jobs!

ATHEY TRUSS WHEEL COMPANY
5631 W. 65th Street, Dept. J, Chicago, Ill.
Cable Address: "Trusswheel" Chicago

"Tough going never stops 'em"

ATHEY
Forged-Trak
REG. TRADE MARK



TO SAVE 29¢ A YARD IT PAYS TO FORGET THE OLD STUFF!

A MODERN Housing Project—spread over a 400-acre area—called for 17,000 cubic yards of concrete distributed in 250 small homes—a powerhouse—and a community building.

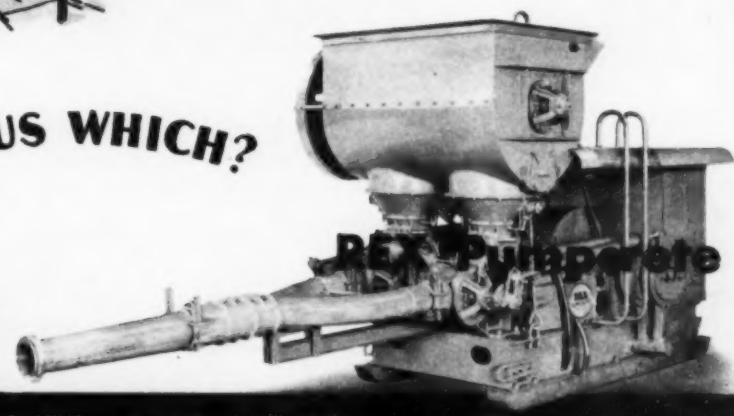
By forgetting equipment and set-up that was already planned, and figuring with two Rex Moto-Mixers, the contractor saved 29c per yard on the estimate based on the use of the old equipment.

Too high a regard for the present equipment list and methods of the years before is often the load that shoots up cost and slows down the job.

In 1936, before you buy, before you bid, investigate the Up-to-Date Methods of Handling Concrete.

CHAIN BELT COMPANY
1664 West Bruce St., Milwaukee, Wisconsin

ASK US WHICH?



The Up to Date Methods of Handling Concrete

REX

CHAIN BELT COMPANY
of MILWAUKEE

Construction Equipment

AFTER an unusually severe winter, what are your roads saying? And what are the tax-paying motorists saying who are traveling over them?

With a wet, spongy subgrade even the best road surfaces will become cracked, rough and prematurely pounded to pieces. Leading engineers agree that over 80 per cent of road surface defects are caused by a faulty, improperly drained subgrade.

The logical solution in a majority of cases is to intercept or remove the excess water by means of a subdrainage system of Armco Perforated Pipe. Thousands of installations are functioning successfully, keeping the roads smooth and safe with a minimum of maintenance.

Ask an Armco engineer to make a survey of some of your worst spots with you, or send in the coupon, and we'll be glad to see that you receive complete information. There's no obligation. Armco Culvert Manufacturers Association, Middletown, Ohio.

Armco

PERFORATED PIPE

STABILIZES THE SUBGRADE

☐ I am interested in obtaining further information on stabilizing subgrade by means of drainage.

Name .....

Title .....

Address .....

City CM-5

Millions of Americans plan to visit the

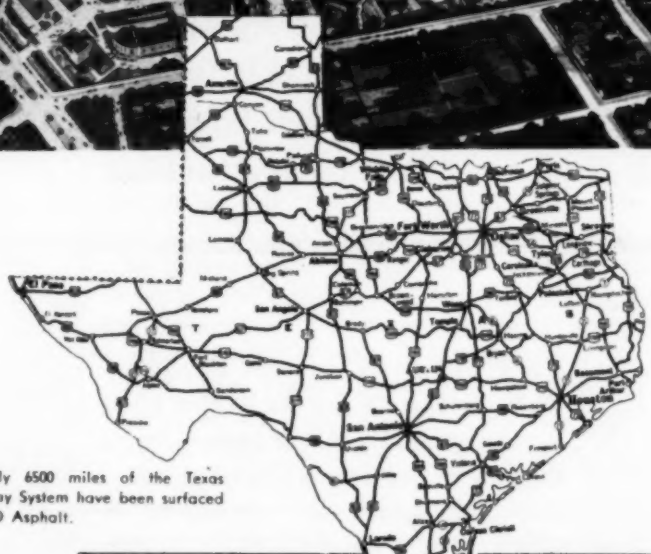
TEXAS CENTENNIAL

The Texas Centennial Exposition, the result of ten years of planning, represents an outlay of more than $25,000,000.

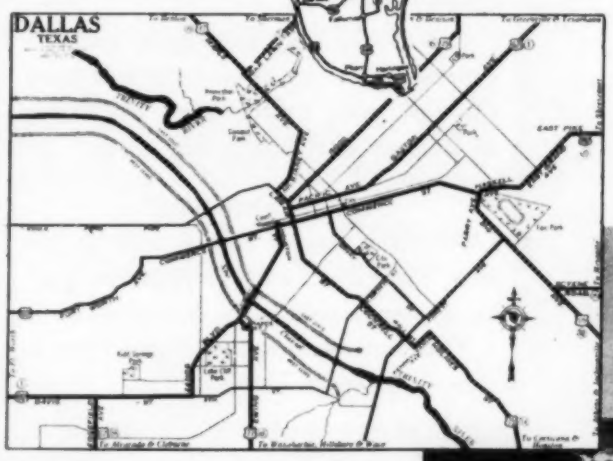
Time, effort, expense. None of these has been spared in the staging of Texas' mammoth Centennial celebration. Everything conceivable has been done to attract visitors and to make their stay memorable.

A great network of modern highways reaches into every corner of the "Lone Star" State, making the many points of interest easily accessible to the visiting motorist.

Approximately 6500 miles of the Texas State Highway System, sections of most of the highways leading into Dallas County, portions of practically all the Dallas streets leading to the Centennial Grounds, and a substantial part of the paving on the Grounds proper have been constructed with TEXACO ASPHALT.



Approximately 6500 miles of the Texas State Highway System have been surfaced with TEXACO Asphalt.



Traffic entering Dallas County, Texas, on any of the following highways, rides on TEXACO Asphalt.

From north, State Hgy. No. 6 (U. S. No. 75)
From north, State Hgy. No. 14
From northeast, State Hgy. No. 1 (U. S. No. 67)
From south, State Hgy. No. 6 (U. S. No. 77)
From southeast, State Hgy. No. 40 (U. S. No. 175)
From southwest, State Hgy. No. 68 (U. S. No. 67)
From west, State Hgy. No. 1 (U. S. No. 80)

TEXACO asphalt

THE TEXAS COMPANY Asphalt Sales Dept.
135 East 42nd Street, New York City

Buffalo
Philadelphia
Richmond
Boston
Jacksonville

Chicago
Cleveland
Kansas City, Mo.
Houston
Dallas

Texaco Asphaltic Concrete pavement on a section of State Highway No. 1 in Dallas County, Texas.

A LE TOURNEAU ROOTER RIPS THE EARTH FOR PITTSBURGH'S PLAYGROUND

Laminated shale and heavy clay, overlaid in part by a heavy telford base (old stone-on-edge paving) turnpike, covered with black top — nearly 18 inches of it — that's what confronted Harrison Construction Company at the beginning of work on Allegheny County's North Park project, Pittsburgh's playground. Harrison put a Le Tourneau Rooter on the job, ripped up the pavement, moved load after load of rock out of the way with Le Tourneau Carryalls. Then the Rooter ripped through a layer of frozen clay and earth and went on to rip up the shale that lay underneath. As a result of this rooting, the loading time of the Carryalls was cut from an average 1.2 minutes to .7, and the average pay load increased from 8 to 9 pay yards.

120 Cubic Yards per Scraper Hour

Here, on a 500-foot, one-way haul, Harrison's two Le Tourneau 12-Yard Carryalls averaged 15 loads each to move 120 yards per Scraper hour.

Harrison's experience is typical — on job after job, the country over, contractors find Le Tourneau Rooters a profitable means of speeding up work, of increasing yardage output. Ask your tractor dealer what Le Tourneau Rooters — all Le Tourneau equipment — can do for you.

Down to the Hilt in Shale — This Rooter and tractor, also used for Bulldozing, easily keep material ripped ahead of two 12-Yard Carryalls.

MANUFACTURERS OF:

ANGLEDOZERS, BUGGIES, BULLDOZERS, CARRYALL SCRAPERS, CRANES, DRAG SCRAPERS, POWER CONTROL UNITS, ROOTERS, SEMI-TRAILERS.

R. G. LE TOURNEAU, INC.

PEORIA, ILLINOIS **STOCKTON, CALIFORNIA**

***Cable Address:* "BOBLETORNO"**

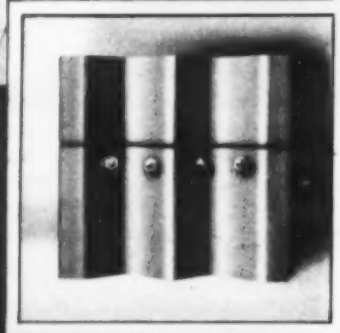
Cutting In — This is hard material, but Le Tourneau Rooters ripped it up and Carryalls cut in to get pay loads of 9 yards consistently.

LE TOURNEAU

Pound for Pound

it's the strongest plate

Brick-lined Armco Structural Steel Plate tunnel. Note how advanced design permits bricks to be laid without cutting. Result is substantial savings in brick-laying costs.



This 13-gage plate carried more than 10 tons concentrated load. Heavier gage plates are proportionately stronger. Strength's in the design.

• Here is a way to gain strength and reduce costs in tunnels and other underground construction work: use Armco Structural Steel Plate Lining. It is equally adaptable to small sewers or the largest railway tunnels.

Balanced design makes it the strongest plate on a pound-for-pound basis. Maximum strength is assured with minimum weight of metal. Not only is the first cost less, but ease of handling and erection makes for greatly-reduced labor costs.

Other advantages include less excavating work; interchangeable plates, fitted ready for installation; virtual elimination of fire hazards; better line and grade and strict adherence to specifications. By using Armco Steel Plate Lining you can do a safer, better job with little or no structural reinforcement.

Write at once for complete information—or, better yet, let us quote definite figures on that next job.

Ingot Iron Railway Products Company, Middletown, Ohio; Berkeley, California.

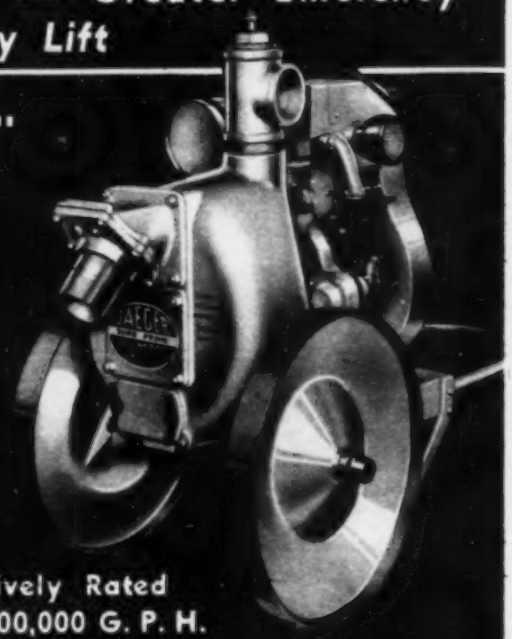
ARMCO

Steel Plate Linings

JAEGER "SURE PRIME" PUMPS

Fastest 100% Automatic Prime — Greater Efficiency at Any Lift

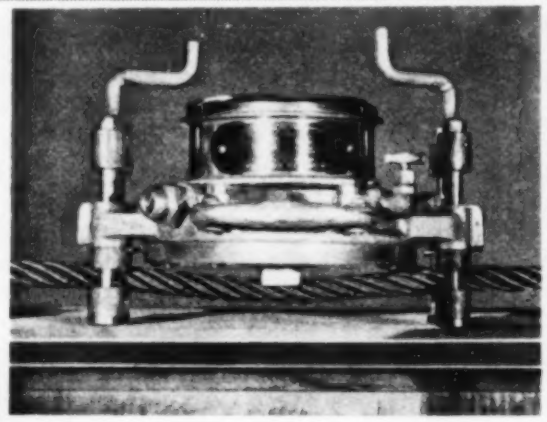
2"
3"
4"
6"
8"
10"
SIZES



Conservatively Rated
7,000 to 200,000 G. P. H.

New Catalog and Prices Will Tell You Why Jaeger Pumps Outsell All Others — Write for It.

THE JAEGER MACHINE CO.
800 Dublin Ave, Columbus, Ohio



Measuring:

The cable strain with remarkable accuracy. Martin-Decker engineers will be glad to consult with you on your particular wire and cable strain measuring problems.

The **Martin-Decker Shunt Type Cable Tension Indicator** supplies valuable operating data on cable problems.

MARTIN-DECKER CORP.
3431 Cherry Ave. Box 249 Long Beach, Cal.
U. S. A.

DEVELOPED IN A LABORATORY

to serve in a tunnel

In such a laboratory as this du Pont developed "Ventube", the flexible ventilating duct. It has served successfully the world over in altitudes ranging from below sea level to 15,000 feet above, meeting all conditions encountered in tunnel driving.

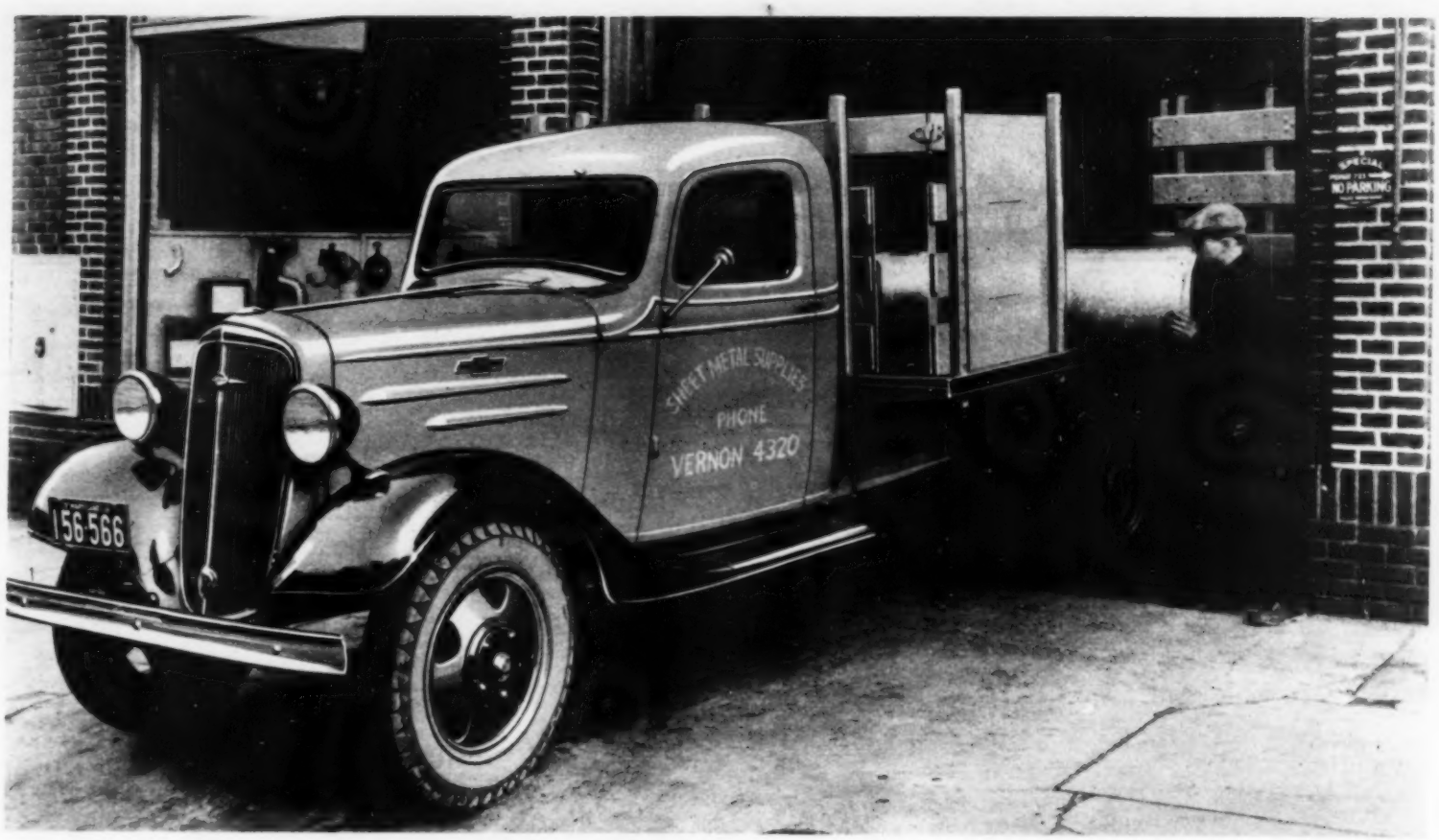
"Ventube" has proved its worth as an engineering tool. It is durable, economical in operation, easily installed, and quickly telescoped back into working place when blasting.

The flexible ventilating duct

DU PONT VENTUBE
REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., INC.

FAIRFIELD · CONNECTICUT



CHEVROLET TRUCKS

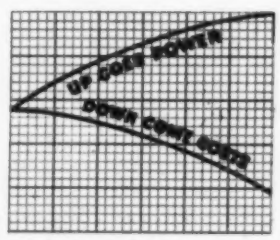
win preference of Contractors and Builders with their great economy and pulling power

NEW PERFECTED HYDRAULIC BRAKES

always equalized for quick, unswerving, "straight line" stops

NEW FULL-TRIMMED DE LUXE CAB

with clear-vision instrument panel for safe control



Close-figuring truck users are not overlooking the daily savings that can be made in their haulage costs. They are buying Chevrolets—*the world's thriftiest high-powered trucks!*

New Chevrolet trucks, powered by a High-Compression Valve-in-Head Engine, have the *greatest pulling power* of any trucks in their price range. They use less gas and less oil. Perfected Hydraulic Brakes give unmatched stopping power. The Full-Floating Rear Axle is strong, reliable and efficient. And Chevrolet's 4-Speed truck Transmission provides even starting of heavily loaded trucks.

Every part is built with extra strength—enduring strength—that assures extra long and dependable service with outstanding economy.

Give Chevrolet trucks a trial—with your kind of loads. Learn with what economy Chevrolet trucks will handle your haulage jobs. Your Chevrolet dealer will gladly arrange a test to suit your convenience.

CHEVROLET MOTOR COMPANY, DETROIT, MICHIGAN

NEW HIGH-COMPRESSION VALVE-IN-HEAD ENGINE

with increased horsepower, increased torque, greater economy in gas and oil

FULL-FLOATING REAR AXLE

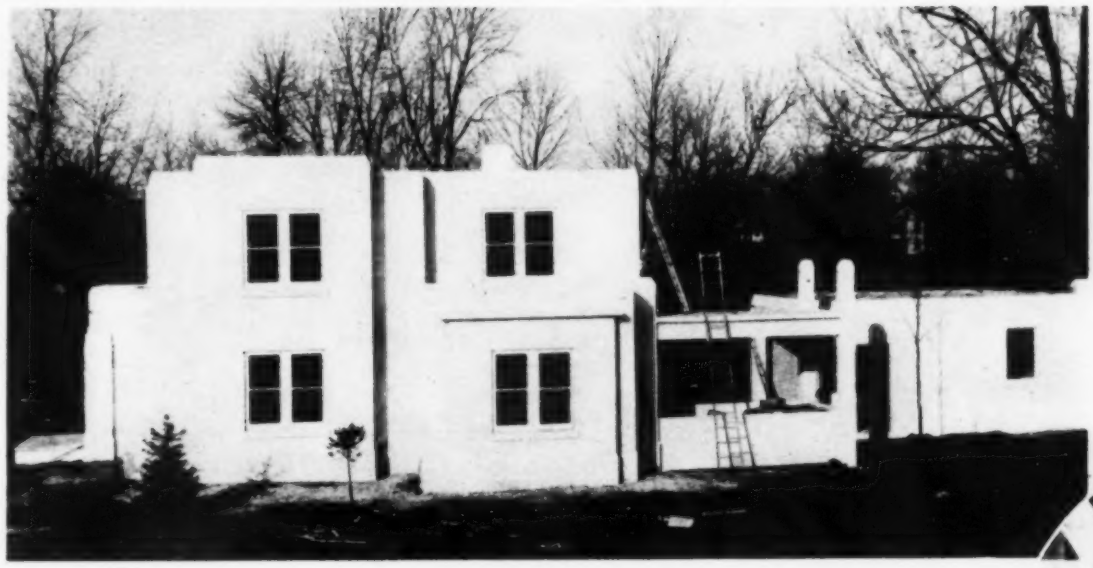
with barrel type wheel bearings on 1½-ton models

GENERAL MOTORS INSTALLMENT PLAN—MONTHLY PAYMENTS TO SUIT YOUR PURSE

FOR ECONOMICAL CHEVROLET TRANSPORTATION

Large Contractors: You will find it profitable to get into the business of building

CONCRETE HOMES



One of Mr. Gambsky's reinforced concrete homes at Menasha, Wis.

Charles Gambsky of Menasha, Wisconsin, has already completed several reinforced concrete homes for individual owners. He will soon start building concrete houses for a realtor in a neighboring city.

THERE'S no doubt about it — home building is definitely on the up-swing. And there's no doubt about the growing popularity of concrete homes. Last year's percentage of concrete homes was the biggest ever, and it's due for another stiff increase in 1936. Concrete construction is being powerfully stimulated by a national advertising campaign plus a national architectural competition that drew over 1500 entries.

What can you do about it? You can follow the lead of Charles Gambsky. He *used* to build bridges, buildings, foundations, elevators, etc. *Now* in addition he builds concrete homes—at a nice profit!

You can enter the business in two ways. You can build complete reinforced concrete houses. Or you can work with realtors and operative builders—building for them the reinforced concrete "shell" (foundation, walls, floors, roof), and concrete improvements around the home such as walks, drives, steps porches and garden pools.

You have the knowledge of concrete, the organization and experience to give you a running start. You have the manifold advantages of concrete to sell. You have new developments that are bringing costs 'way down. And you have concrete's unique adaptability to individual homes and to large scale housing developments.

Write us for the practical, informative manual, "*Reinforced Concrete Houses — Construction Details.*"

Another home by the same builder now under construction for Purdue University.

PORTLAND CEMENT ASSOCIATION

Dept. A5a-16 — 33 W. Grand Ave., Chicago, Ill.

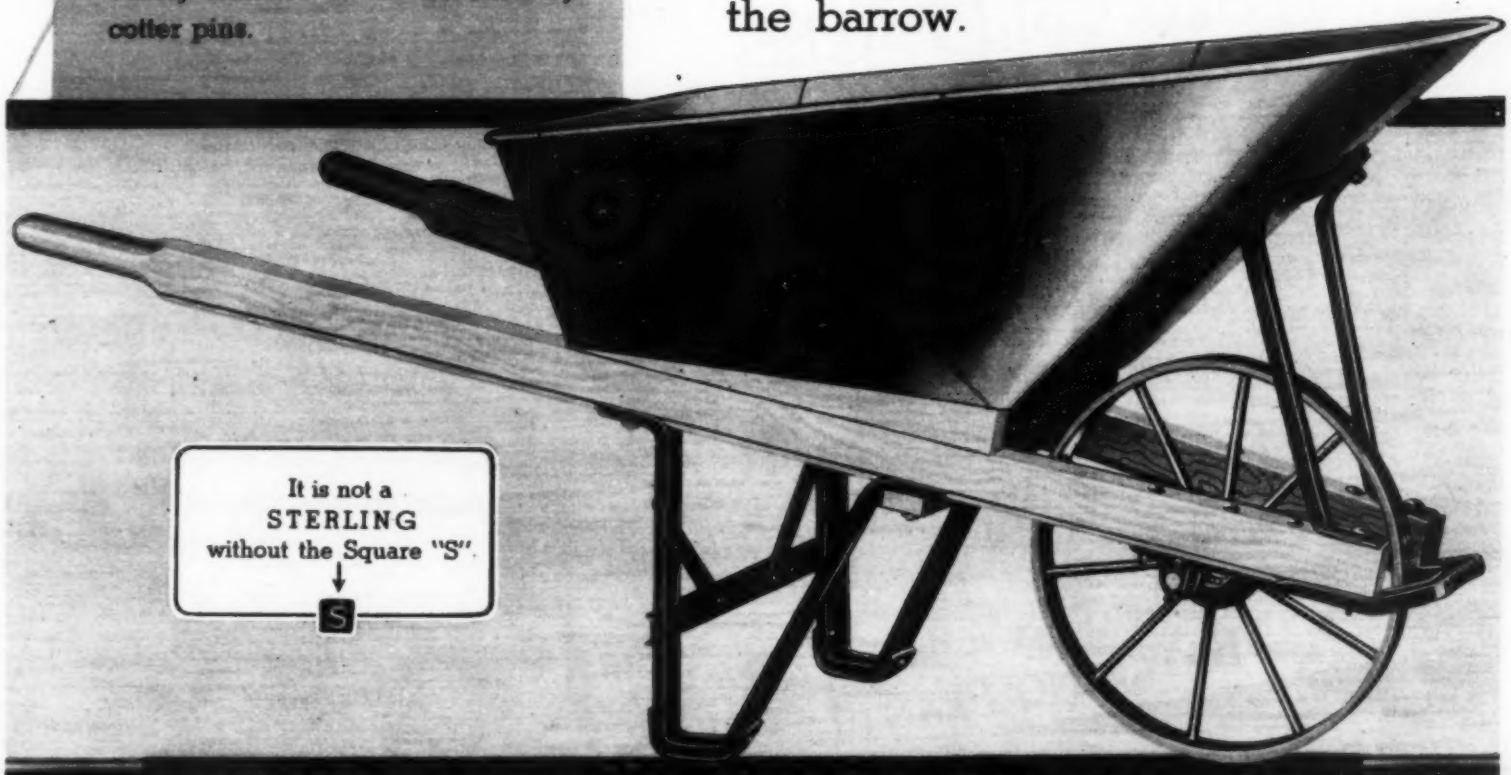
Sterling BALANCED WHEELBARROWS

● The wheels used on Sterling contractors barrows have 10 spokes. The short distance between spokes at tire prevents flat spots. Every Sterling wheel is equipped with self-lubricating bushings.

● Wheel brackets are made of malleable iron to prevent breakage under shock or hard use. In place of a bolt or a piece of rough stock a cold rolled steel axle is used in Sterling wheels. This axle is securely fastened to the brackets by cotter pins.

A COMPLETE LINE OF Barrows and Concrete Carts

STERLING WHEELBARROWS are designed to balance the greater part of the load over the wheel. In a wheeling position more than 80% of the combined load of barrow and contents is carried by the wheel, leaving less than 1/5th of the load supported by the man wheeling the barrow.



STERLING WHEELBARROW CO.

900 SOUTH 71ST STREET

MILWAUKEE · WISCONSIN, U.S.A.

Step-by-Step

Handling Forms

By ADOLPH J. ACKERMAN

Step-by-Step Field Methods

Raised-Edge Curb for Concrete Pavement

Building Wreckers Develop

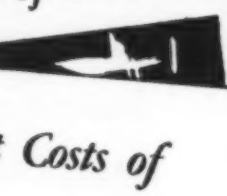
"Upside-Down" Method

of Orderly Demolition

HYDRAULIC BORING MACHINE

Installs Telephone Conduits Under

Main-Line Tracks of Railroad



Portable Repair Units Cut Costs of

Asphalt Cold Patches

PUMPED CONCRETE

Cuts Cost of Floors and Roof of

Five-Story Albany Post Office

STIFF-LEG DERRICKS

Handle Materials for

How to Increase Efficiency at the

BATCHING PLANT

From a report by ANDREW P. ANDERSON Highway Engineer,

Planning and Planting

Medium-Sized Jobs

By J. B. BURGHARDT,
Formerly Construction Superintendent for J. R. Hampson & Co., Inc.,

HOW

. . .

The reading pages show you "HOW"—

The advertising pages show you "WHAT WITH"—

— a service combination hard to beat.

. . . .

See page 3 for "HOW" items in the editorial pages.

See pages 88 and 89 for "WHAT WITH" items made by manufacturers whose advertisements appear in this issue.

If you do not find what you are looking for—

Write

CONSTRUCTION METHODS
Information Bureau
330 West 42nd St., New York City

FASTER

The BADGER
...AS QUICK AS THE HAND AND EYE OF THE EXPERT OPERATOR

● And it is an easier, faster, safer shovel for anyone!

The Badger will keep pace with the hand and eye of the fastest operator. Start—swing—stop as fast as you like and yet move a generous ½-yard bite each time.

Why faster? The Badger has less swinging weight. Motor does not swing with boom. Hence, less deadweight to start and less deadweight to stop. Boom dipper and dipper-stick are of light alloy steel, giving bigger payload and still saving on total weight. Low center of gravity holds the Badger steady in hardest digging.

Yes, the Badger is faster! No dangerous tailswing. Nothing to watch except the work, and unobscured vision for that. Ample power. Quick-acting brakes. 41 anti-friction bearings between transmission and dipper sheave. Travels to new jobs at motor truck speeds on its own wheel mounts.

There is more output in an Austin-Western.

New Shovel Bulletin sent on request.

The Austin-Western Road Machinery Co.

Home Office: Aurora, Illinois Cable Address: AWCO, Aurora

Branches in 14 Principal Cities

WHERE THE BADGER *gains time*

The Badger is "full speed" for a much greater portion of the swing

Austin-Western

ROAD GRADERS · MOTOR GRADERS · ELEVATING GRADERS · DRAGS
ROAD ROLLERS · DUMP WAGONS · DUMP CARS
SCARIFIERS · BULLDOZERS · TRAILERS · SCRAPERS · PLOWS
BITUMINOUS DISTRIBUTORS · ROAD-MIX MACHINES · CULVERTS
CRUSHING AND WASHING PLANTS · SWEEPERS AND SPRINKLERS · SHOVELS · CRANES · ETC · SNOW PLOWS

The Austin-Western Road Machinery Co.
A-6, Aurora, Illinois
Please send me new Shovel Bulletin.

Name.....
Address..... 618
City..... State.....

PROFITABLE LOADING

There'll be more yardage for you in 1936 . . . more reason for profitable, up-to-date loading methods. Saving a few cents a yard will mean hundreds of dollars of extra profit.

The Barber-Greene Model 82 Bucket Loader can't be beaten for low cost loading. It's rated at 2 to 3 yards a minute. Clocked at 4.

A one cent card will bring complete details on the new Synchronized Feeding, Slow Crowding, Knee Action Oscillating Axle, Tank Type Chassis Frame, Welded Buckets, Hard Faced Bucket Lips, Quick Acting-Self Locking Swivel Spout, Floating Boom, Automatic Overload Release, and many other B-G Features.

Phone, write, or wire. There is no obligation.

Barber-Greene Company

530 W. Park Ave. Aurora, Ill.

36-1

EQUIPMENT and MATERIALS

An index of products made by manufacturers whose advertisements appear in this issue of Construction Methods.

If you do not find all you need in the advertising section, we shall be glad to assist you. Write to—

CONSTRUCTION METHODS
Information Bureau
330 West 42nd St. New York City

ASPHALT
Texas Company

ASPHALT PLANTS
Blaw-Knox Company
Hetherington & Berner, Inc.

BACK FILLERS
Austin Western Road Mchry. Co.
Harnischfeger Corp.
Link Belt Co.
Northwest Engineering Co.

BARS, IRON AND STEEL
Inland Steel Co.

BATCHERS, ADJUSTABLE MEASURING
Blaw-Knox Company

BATTERIES, STORAGE
Firestone Tire & Rubber Co.

BELTING
Firestone Tire & Rubber Co.
Goodall Rubber Co.

BINS, STORAGE
Blaw-Knox Company
Chain Belt Company
Ransome Concrete Mchry. Co.

BLASTING ACCESSORIES
Atlas Powder Co.
Ensign-Bickford Co.

BOLTS, NAILS, NUTS, RIVETS and SPIKES
Inland Steel Co.

BOOKS, ENGINEERING and TECHNICAL
McGraw-Hill Book Co.

BOOTS, RUBBER
Goodall Rubber Co.

BUCKETS
Blaw-Knox Company
Bucyrus-Erie Co.
Harnischfeger Corp.
Insley Mfg. Company
Northwest Engineering Co.
Ransome Concrete Mchry. Co.

BUILDINGS, STEEL
Blaw-Knox Company

BULLDOZERS
Baker Mfg. Co.
Le Tourneau, Inc., R. G.

CABLEWAYS
Roebling Son's Co., J. A.

CABLE, ELECTRIC
General Electric Co.
Roebling Son's Co., J. A.

CALCIUM CHLORIDE
Calcium Chloride Assn.

CARTS, CONCRETE
Ransome Concrete Mchry. Co.
Sterling Wheelbarrow Co.

CEMENT
International Cement Corp.
Portland Cement Assoc.
Universal Atlas Cement Co.
(U. S. Steel Corp. Subsidiary)

CEMENT (BULK) HANDLING EQUIP.
Barber-Greene Co.
Blaw-Knox Company

CHAIN STEEL & MALLEABLE SPROCKET
Link Belt Co.

CHUTES, CONCRETE
Insley Manufacturing Co.
Ransome Concrete Mchry. Co.

COMPRESSORS, AIR
Allis-Chalmers Mfg. Co.
General Electric Co.
Novo Engine Co.

CONCRETE CURING MATERIAL
Calcium Chloride Assn.

CONCRETE REINFORCEMENT
Inland Steel Co.
Wickwire Spencer Steel Co.

CONCRETE SLAB RAISING EQUIPMENT
Koehring Company

CONVEYING & STORAGE SYSTEMS
Barber-Greene Co.
Chain Belt Company
Link Belt Co.

CONVEYORS, BELT, BUCKET & CHAIN
Barber-Greene Co.
Chain Belt Company
Link Belt Co.
Wickwire Spencer Steel Co.

CRANES, GAS, ELECTRIC, DIESEL & STEAM
Austin Western Road Mchry. Co.
Bucyrus-Erie Co.
Clyde Sales Co.
Harnischfeger Corp.
Koehring Company
Link Belt Co.
Manitowoc Engineering Co.
Michigan Power Shovel Co.
Northwest Engr. Co.
Ransome Concrete Mchry. Co.
Thew Shovel Co.
Universal Crane Co.

CRANES, MOTOR TRUCK
Thew. Shovel Co.
Universal Crane Co.

CRAWLER ATTACHMENTS
Trackson Company

CRUSHERS & PULVERIZERS
Acme Road Mchry. Co.
Allis-Chalmers Mfg. Co.
Austin Western Road Mchry. Co.
Galion Iron Works & Mfg. Co.
Good Roads Mchry. Co.

CULVERTS
Armco Culvert Mfrs. Assn.
Austin Western Road Mchry. Co.
Johns-Manville Corp.

DERRICKS & DERRICK FITTINGS
Clyde Sales Co.
Dobbie Fdry. & Mach. Co.
Harnischfeger Corp.

DRAGLINES
(See Cranes & Shovels)

DRAINPIPE
Johns-Manville Corp.

DRAWING PAPER
Wade Instrument Co.

DREDGES
Bucyrus-Erie Co.
Harnischfeger Corp.

DRILLS, WAGON
Bucyrus-Erie Co.

DUMP BODIES, TRUCK
Athey Truss Wheel Co.

DYNAMITE
Atlas Powder Co.

ELEVATORS, BUCKET
Chain Belt Company
Link Belt Co.

ELEVATORS, CONTR. MATERIAL
Barber-Greene Co.
Chain Belt Company
Galion Iron Works & Mfg. Co.
Link Belt Co.
Ransome Concrete Mchry. Co.

ENGINES, PORTABLE
Allis-Chalmers Mfg. Co.

ENGINES, STATIONARY, DIESEL & GAS
Caterpillar Tractor Co.
Novo Engine Co.

EXCAVATORS, DRAGLINE
Austin Western Road Mchry. Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Insley Mfg. Company
Koehring Company
Link Belt Co.
Northwest Engr. Co.
Novo Engine Co.
Thew Shovel Co.
Universal Crane Co.

EXCAVATORS, DITCH & TRENCH
Baker Mfg. Co.
Barber-Green Co.
Bucyrus-Erie Co.
Harnischfeger Corp.
Koehring Company.
Link Belt Co.
Northwest Engr. Co.
Thew Shovel Co.
Universal Crane Co.

EXPLOSIVES
Atlas Powder Co.

FLOODLIGHTS
General Electric Co.

FLOORING
Barrett Company
Johns-Manville Corp.
Texas Company

FLOOR PLATES, STEEL
Inland Steel Co.

FLOORS, ASPHALT MASTIC
Johns-Manville Corp.

FORMS, CONCRETE
Blaw-Knox Company

FORMS, PIPE
Quinn Wire & Iron Wks.

FUSE, BLASTING
Atlas Powder Co.
Ensign-Bickford Co.

GENERATORS, ELECTRIC
General Electric Co.

GRADERS, ROAD
Acme Road Mchry. Co.
Allis-Chalmers Mfg. Co.
Austin Western Road Mchry. Co.
Blaw-Knox Company
Caterpillar Tractor Co.
Galion Iron Works & Mfg. Co.
Good Roads Mchry. Co.

GRAVEL WASHING PLANTS
Austin Western Road Mchry. Co.
Galion Iron Works & Mfg. Co.

GRINDERS
White Manufacturing Co.

GUARD RAILS, HIGHWAY
Hazard Wire Rope Co.
Wickwire Spencer Steel Co.

HOISTS, GAS, ELECTRIC, DIESEL & STEAM
Allis-Chalmers Mfg. Co.
Clyde Sales Co.
Construction Machinery Co.
Dobbie Fdry. & Mach. Co.
Harnischfeger Corp.
Novo Engine Co.
Sterling Machinery Corp.

HOISTS, HAND
Chain Belt Company
Coffing Hoist Company
Sterling Machinery Corp.

HOSE, AIR, WATER & STEAM
Goodall Rubber Co.

JOINTS, ASPHALT & CORK
Johns-Manville Corp.

JOINTS, EXPANSION
Johns-Manville Corp.

JOINTS, PAVING
Barrett Company
Flexible Road Joint Machine Co.
Texas Company
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